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ACUTE DILATATION OF THE STOMACH, AND ITS RELATION TO MESENTERIC OBSTRUCTION OF THE DUODENUM.

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Although in recent years contributions to the subject of acute dilatation of the stomach have been fairly numerous in England and Germany, in this country the subject has received but little attention. Nevertheless the condition is one of considerable clinical interest and importance. Cases are encountered by the surgeon, the gynecologist and the orthopedist, as well as by the physician, and the condition has developed during apparently normal convalescence from operations or from some severe illness, changing, within a few hours, perhaps, the whole aspect of the case. While in most recorded instances the disease has progressed rapidly to a fatal termination, evidence is accumulating to show that in many cases life may be saved by timely recognition of the condition and by suitable treatment.

The possibility of such acute dilatation has long been known. Brinton, writing in 1859, discusses the subject and gives a short account of its clinical features. It was Hilton Fagge, however, who first directed general attention to the condition and gave an accurate description of the characteristic symptoms and physical signs. Since that time (1873) cases have gradually accumulated, until in 1902 Campbell Thomson was able to collect 44 instances of the disease—most of them with autopsy reports. The more recent review of the subject by Neck was based upon 60 cases. For the present study of the condition 102 cases have been collected and analyzed.

The accumulation of cases has made it evident that, in many instances at least, the clinical picture is very distinct and easily recognizable, and that the diagnosis is often not difficult if the possibility of the disease is borne in mind. There is also reason to believe that with the earlier recognition of the condition it will be possible to treat successfully many cases which have heretofore proved fatal. Concerning the pathogenesis of the disease, however, our knowledge is by no means so satisfactory and there exist still much confusion and uncertainty as to the nature of the affection and its causation.

In studying the recorded cases it soon becomes apparent that the condition of acute dilatation of the stomach rests upon no single pathological basis. A consideration of the extremely diverse etiological features and of the varying postmortem findings makes this very evident. Nevertheless it seems to have been clearly demonstrated within the last few years that a very important cause—perhaps the most important single cause—of such stomach dilatation is the sudden incarceration of the lower end of the duodenum between the root of the mesentery which passes in front of it and the vertebral column behind. The possibility of such mesenteric obstruction of the duodenum was expressly noted by Rokitansky in 1863. No illustrative cases were recorded, however, until 1891, when Kundrat, under the caption "Concerning a Rare Form of Intestinal Incarceration," described three such cases. These all had run a rapidly fatal course, and in two of them the necropsy showed great dilatation of the stomach as well as of the duodenum. Schnitzler, in 1895, reported another fatal case with enormous dilatation of the stomach and duodenum, and also an apparently similar case cured by treatment directed to the relief of the supposed duodenal compression.

The subject received no other notice, however, until Albrecht, in 1899, published a very complete and careful study of it. He reported two cases of acute gastric dilatation with the same mesenteric constriction of the duodenum, and discussed at length the relation of the two conditions to each other. Since Albrecht's communication a good deal further study has been made, chiefly in Germany, and a number of additional cases have been recorded. It should be mentioned that in 1900 Robinson, of Chicago, without knowledge of the literature of the subject, and believing that he was describing a hitherto unrecognized condition called attention to the possibility of such compression of the duodenum by the root of the mesentery and reported a fatal case associated, as usual, with enormous dilatation of the stomach.

The following similar case occurred in my service at the New York Hospital, and through the kindness of Dr. Farr of the house staff I was fortunate enough to secure photographs of the postmortem appearances.

Male, aged twenty-one years, Italian tailor, was admitted to the hospital on August 1, 1905. He had had malaria ten years before in Italy, but otherwise had always been perfectly well except for an occasional slight cough. There was no history of tuberculosis in the family. For four weeks before admission he had noticed progressive weakness and loss of flesh, had had slight cough, some dyspnœa, and some profuse night sweats. No pain. During the last few days he had been irrational at times. The bowels were constipated. Admission: temperature, 99.8°; respiration, 36; pulse, 116.

Physical Examination. Man of medium frame, very poorly nourished; mucous membranes pale. Pupils of equal size, reaction

FIG. 1.—The dilated stomach due to mesenteric obstruction of the duodenum.

normal. Tongue moderately coated. Throat congested and dry. Neck somewhat stiff. No subcutaneous œdema. Lymph nodes in neck, axillæ, and groins palpable.

Lungs. In front slight dulness at right apex. Exaggerated vocal fremitus over same area. Vesicular breathing everywhere. Sibilant and sonorous rhonchi over both chests. Some medium-sized moist rales, especially with expiration, in both axillæ. Behind, slightly impaired resonance at the right apex. Auscultation signs similar to those in front,

Heart. Maximum impulse in fourth space four and one-half inches to left of midsternal line; action feeble, regular, and rapid. Relative dulness begins above at third rib, on the right side at right border of sternum, on the left side at line of apex. Sounds all normal except some accentuation of second pulmonic. Pulse rapid, regular, small, and weak. Artery walls somewhat thickened.

Abdomen. Retracted and somewhat rigid, has rather a doughy feel, but no masses can be felt. No rose spots. Liver dulness reaches to two fingers' breadth below costal margin, edge indistinctly felt. Right kidney palpable. Edge of spleen felt at costal margin.

The temperature rose at once to 103° and thereafter ranged constantly between 100° and 104°, with morning remission and evening rise, forming a chart very suggestive of typhoid fever.

Repeated examinations of the sputum throughout the illness yielded negative results for tubercle bacilli. Tests for the Widal reaction were all negative. Leukocytes: August 2, 34,000 in c.mm.; 8th, 26,000; 21st, 12,000.

August 15. Hemoglobin, 56 per cent.; red cells, 4,000,000. Examination for malarial plasmodia negative. Blood cultures taken on two occasions failed to yield any growth. Urine showed at each examination a trace of albumin and a few hyaline and granular casts. Diazo reaction positive.

5*th.* Condition and physical signs almost unchanged since his admission. Fever continuous. Mental state "queer." Takes very little food.

9*th.* Small moist rales scattered irregularly throughout both chests anteriorly; edge of spleen now felt over finger breadth below costal margin.

14*th.* Still slight dulness at right apex in front. Auscultatory signs of general bronchitis.

23*d.* General condition worse. Involuntary micturition and defecation. Will take almost no food, but drinks water freely. Fed by gavage. Spleen is decidedly larger than on admission. Complains of no pain. Belly retracted and somewhat rigid. No rose spots. Diagnosis of acute miliary tuberculosis seems very probable by exclusion, but in the absence of evidence of ocal tuberculosis cannot be made with certainty.

28*th.* Patient has been eating better for past day or two. Slept soundly last night. This morning about 9.30 suddenly complained of severe abdominal pain. He was seen almost immediately by the house physician, who found a marked distention of the left side of abdomen, especially above the umbilicus. Lower border of this circumscribed prominence could be made out just below umbilicus. The distended area gave deep tympany on percussion, was very tender to pressure, but there was no real rigidity of the abdominal muscles. The severe pain continued, the general

condition grew rapidly worse, and at 12.40 P.M. (three hours after onset of pain) he died. There was no vomiting at any time.

Autopsy. Two hours after death (Dr. Biggs).

Anatomical Diagnosis. Acute general miliary tuberculosis; chronic tuberculosis of the bronchial and mediastinal lymph nodes; enormous dilatation of the stomach; obstruction of the duodenum by the root of the mesentery.

Body greatly emaciated, slight rigor mortis. No subcutaneous œdema. Abdomen somewhat distended. Upon opening the ab-

FIG. 2.—View of same case, after the stomach had been turned upward and the transverse colon removed, showing the greatly distended duodenum, the constricting root of the mesentery, and the collapsed first portion of the jejunum. *a*. Dilated duodenum. *b*. Root of the mesentery. *c*. Collapsed jejunum.

domen an enormously enlarged stomach presents. Peritoneum normal. The pericardial sac contains 150 c.c. of clear serous fluid. Near the base of the right ventricle is a miliary tubercle in the visceral layer. The heart is small, the cavities slightly dilated, the muscle pale and soft, the valves and coronary arteries normal. The bronchi contain much mucopus. The lungs are of light

color and very emphysematous. Miliary tubercles are numerous beneath the pleura and throughout both lungs. No old tuberculous lesions are found in any part of the lungs. The bronchial and mediastinal lymph nodes are much enlarged and show extensive caseation, but no softening. These caseous nodes extend up along and behind trachea into neck. The spleen is greatly enlarged; it measures 17.5 by 11.5 by 8 cm., and weighs 620 grams. The great size is due to presence of myriads of tubercles, 2 to 4 mm. in diameter. Remaining splenic pulp very hyperemic, so that tubercles stand out sharply. The left kidney weighs 140 grams, the right 185 grams. Few small tubercles in each; capsules not adherent; surface smooth; markings distinct; pelvis and ureters normal. The stomach is enormously enlarged and distended by gas and 650 c.c. of greenish-brown fluid. Greater curvature extends to within 7 cm. of symphysis. Distance from fundus to lowest part of greater curvature is 31 cm. Pylorus in normal position and patulous. Duodenum 7 cm. in diameter and tensely distended with fluid to point where mesentery crosses it. Remainder of small intestine is collapsed and lies chiefly in pelvis. Owing to catarrhal inflammation, slight œdema and absence of gas; the small intestine is heavy and with its mesentery weighs 750 grams. The weight of this mass as it hangs into the pelvis drags heavily on the mesentery and causes firm pressure upon the terminal part of duodenum. A finger introduced into duodenum encounters complete obstruction at this point, which is relieved by raising the mesentery. In this constricting band of mesentery the superior mesenteric artery can be felt as a tense, firm cord. No structural changes in duodenum or pylorus. The stomach wall is very thin. Pancreas normal. The suprarenal bodies are normal except for a single tubercle in the right one. Liver weighs 1600 grams, and is normal except for the presence of vast numbers of tubercles. Lymph nodes about pancreas, lesser omentum, retroperitoneal region, groin, and axillæ are all somewhat enlarged and most of them contain fairly large tubercles. Mesenteric nodes slightly swollen. No tubercles. The other organs are normal.

Microscopically the stomach mucosa shows a fairly marked catarrhal inflammation. The muscular layer seems about half its usual thickness. There is no apparent separation of the muscle bundles, and no structural change appreciable in the fibers.

This case differs from most of those reported (1) in the remarkably short duration of the symptoms, and (2) in the entire absence of vomiting. No immediate cause for the development of the condition could be discovered. The patient had for many days taken only very small quantities of liquid food and that morning had had only a part of a glass of milk. The bowels had moved almost daily up to the time of his death. While there is no certainty that the stomach may not have been dilated before his terminal

symptoms began, there had been nothing to suggest this. He had had no gastric symptoms other than anorexia, and, although his abdomen had been examined frequently and carefully, there had been found no increase of stomach tympany, no splashing, no visible peristalsis. During the last week or two of his life he had kept the dorsal position in bed almost constantly. The probable influence of this, and of the almost complete abstention from food, in favoring the production of mesenteric obstruction of the duodenum will be discussed later.

In addition to the case just described I am able, through the courtesy of Dr. James Ewing, to furnish brief notes of another instance of acute dilatation of the stomach.

The patient, a man aged twenty years, was under observation for about six weeks and presented the picture of chronic pulmonary tuberculosis, with hectic fever, chills, emaciation, anorexia, and cough. Aside from occasional vomiting with the paroxysms of coughing, he presented neither symptoms nor physical signs of any stomach disorder. His condition remained practically unchanged until two days before his death, when he suddenly began to vomit large quantities of greenish fluid. His urine became scanty and bloody, vomiting persisted, his condition changed rapidly for the worse, and he died within forty eight hours of the onset of the violent gastric symptoms.

The autopsy revealed, in addition to the lesions of advanced pulmonary tuberculosis, a stomach enormously distended and reaching to within three inches of the symphysis pubis. No lesion was found to explain the enormous dilatation. The small intestine showed no abnormality other than a moderate grade of congestion. There was no peritonitis.

ETIOLOGY. The following study of acute dilatation of the stomach is based upon an analysis of 102 cases:

Age. In 90 cases in which the age of the patient is given the percentages according to decades are as follows: First, 4 per cent.; second, 20 per cent.; third, 36 per cent.: fourth, 19 per cent.; fifth, 14 per cent.; sixth, 5 per cent.; seventh, 2 per cent. It will be noted that three-fourths of all the cases developed during adolescence or in early adult life, *i. e.*, between the tenth and the fortieth years. The youngest case was that of a child of three years (Dickinson); the oldest that of a woman of sixty-nine (Kundrat).

Sex. Males were affected in 47 per cent. of the cases; females in 53 per cent.

In studying the state of health of the patients at the time of the onset of the symptoms, and the conditions which seemed to bear on the orgin of the disease, it is seen that the cases fall into several more or less well-defined groups:

1. *Those following Operation with General Anesthesia.* These constitute much the largest group and include 42 cases (41 per

cent.); 15 followed various operations upon the gall-bladder and bile passages (Riedel, Robson and Moynihan, Kehr, and others); 17 developed after other abdominal operations, such as removal of the uterus (v. Herff, Braun), operations on the kidney (Morris, Thomson, Borchardt), etc.; and the remaining 10 cases after operations upon various other parts of the body, chiefly joints. Thus the condition has complicated excision of the knee (Goodhart); of the hip (Jessop); of the elbow (Albrecht); amputation of the thigh (Box and Wallace, Goodhart); amputation of the breast (Albrecht); tenotomy of the tendo Achillis (Müller), etc. It is worthy of note that no instance was found in which acute dilatation had followed operation upon the stomach itself. In almost all the cases in which the nature of the anesthetic used is mentioned it has been chloroform. In one instance, however (Herrick), it is noted that ether (preceded by nitrous oxide gas) was used; and in a number of other cases in which the anesthetic is not mentioned it seems altogether probable that ether was the drug employed.

The time of the advent of the symptoms of dilatation could be determined with reasonable accuracy in 32 cases. In 16 of these they appeared within the first twenty-four hours after operation, and the usual postnarcotic vomiting merged imperceptibly into that of the acute dilatation; in 7 cases the symptoms appeared during the second twenty-four hours, and in 7 others between the third and the seventh day after operation. Once (Robson, Case I) the condition manifested itself, without known cause, on the tenth day of convalescence, and again (Robson, Case III) two weeks after operation. In this latter case the symptoms appeared after eating a raw apple. In a number of the cases the stomach had been seen at the time of operation and nothing abnormal had been noted.

2. *Those Occurring in the Course of or during Convalescence from Severe and Wasting Diseases.* The condition has been met with five times in the course of lobar pneumonia, three times in chronic pulmonary tuberculosis, and once each in general miliary tuberculosis, long-standing hip-joint disease, severe and protracted sciatica, severe chorea, grave anemia, and inoperable sarcoma of the humerus. Meyer has seen it develop in a case of mental disease of long standing (without polyphagia). The symptoms have appeared during convalescence from typhoid fever in four instances. In one of these (Kundrat) they developed immediately upon the patient leaving his bed for the first time. The condition has also been seen during convalescence from severe scarlet fever, from pneumonia, and from some obscure fever. In this group the features common to most of the cases have been long-continued decubitus, prostration, and emaciation.

3. *Cases Developing after Injuries.* Acute dilatation of the stomach has followed injury to the head or spine in four instances.

Rosenheim observed it after a fall upon the shoulder and head (without fracture). In Campbell Thomson's patient it followed fracture of the base of the skull and of the cervical spine. Edmunds records a case of shot wound of the lower dorsal spine, with complete paraplegia, in which thirty-four days after the injury symptoms of acute dilatation suddenly appeared and terminated fatally in nine hours. Erdmann saw the immediate development of dilatation after a fall upon the back in which the body was bent sharply backward. A slight blow upon the abdomen seemed to be the exciting agent in a case of Box and Wallace.

4. *Cases Ascribed to Errors in Diet (Dilatatio ex Ingestis).* Indiscretion in diet is given as the direct or contributing cause in fifteen instances; with what justification it is not always easy to determine. Nine times the symptoms developed after a single large meal in persons in good health (Boas, Broadbent, Fränkel, Heine, Hoffmann, Körte, Kirch, Kundrat, and Valsalva). In Broadbent's case the patient had been tramping for two days without food. After a large meal of roast pork he developed severe abdominal pain and vomiting and died at the end of two days. In Heine's case the stomach had been examined a short time before and had been found to be normal in size and in motor function. The symptoms began in Kirch's patient after a supper of two plates of soup and a glass of beer. Six times other possible causes existed along with errors in diet. In Bennett's patient, who was ill of empyema, the symptoms followed the drinking of two bottles of effervescent lemonade. In two instances (Buzzard, Kelling) the patients were encased in plaster jackets (for spinal deformity), and the symptoms appeared after a copious meal. Acute dilatation developed in a woman seven months pregnant after bodily fatigue and the drinking of a glass of cold milk (Dyson). In a case of valvular heart disease dilatation and death supervened after distention of the stomach with food (Goodhart). A patient convalescent from typhoid fever developed evidences of dilatation of the stomach after drinking a very large amount of fluid (Heine).

5. *An Interesting Group of Cases is that Associated with Disease and Deformity of the Spine.* There are 6 such cases; 3 of these (Buzzard,[1] Kausch, 2 cases) were instances of Pott's disease with dorsal kyphosis and (in 2 cases at least) increased lumbar lordosis. In 1 case (Willett) there was a uniform posterior (kyphotic) curve of the whole dorsal and lumbar regions; in another (Kelling) a dorsolumbar scoliosis, and in a third (Kirch) a rachitic dorsal kyphoscoliosis. A further interesting fact is that in 3 of the above cases the gastric symptoms became manifest while the patients were enveloped in a plaster-of-Paris corset (Buzzard, Kelling, Willett).

[1] This case is often credited to Perry and Shaw.

6. Finally there are 4 cases (W. H. Brown, Miller and Humby, Simon, Wright) in which the symptoms of acute stomach dilatation appeared while the patients were in their usual good health, and for which no cause whatever is assignable. In another case (Schmorl) the symptoms appeared immediately after a violent paroxysm of laughing.

SYMPTOMS. Vomiting, pain, abdominal distention and tenderness, constipation, thirst, scanty urine, and rapid collapse are the chief and common symptoms.

Vomiting is unquestionably the most constant and most important. It has been present in over 90 per cent. of the cases reported. In only 2 cases (v. Herff, Case II; Conner) has its absence throughout been specifically noted, although in 3 other instances (Borchardt, Dickinson, Edmunds) no mention is made of it among the symptoms. The vomiting in most cases appears at the beginning and persists throughout the illness. In a number of instances, however, it has been noted that the vomiting ceased a day or two before death, and once (Bennett) it began only after severe abdominal pain had lasted for five days. "Persistent," "incessant," "uncontrollable," "profuse," are the terms usually used in describing it. The quantity of fluid vomited has varied greatly, but in general it has been noticeably large. Many writers comment upon the surprisingly large amounts brought up. Morris was so struck with the quantity vomited in his case that he looked upon the excessive secretion of fluid as the primary condition and the dilatation of the stomach only as the result, and he proposed for the condition the name of "acute gastrorrhœa." In Miller and Humby's case "five basinfuls" of fluid were vomited during one night, and in a number of the cases as much as several quarts of fluid have been removed from the stomach at one time.

The vomited material is usually of thin, watery consistence. Its color varies much, but is generally some shade of green. Occasionally it is "brown" or "blackish," and in many instances the vomit is described only as "bilious." There can be no doubt that bile is present in the vomit in most of the cases. In several instances small quantities of blood could be detected in the stomach contents. A feature of much diagnostic importance is the fact that although the vomitus has sometimes been foul-smelling, it has only rarely been feculent. In 3 instances only was the vomit noted as distinctly fecal (Kundrat, Lehmann, MacEvitt), and in 1 other (Willitt) it is described as "stinking."

Concerning the chemical character of the fluid vomited or removed by tube but little has been learned. In both of Baümler's cases an absence of free HCl was noted. In one of these lactic acid was present and the fluid showed also the biuret reaction and the presence of a diastatic ferment. Herrick found bile present, a total acidity of 18 units, no free HCl, and no lactic acid. Kelling's

case showed no free HCl, but much lactic acid. On the other hand, Heine found a total acidity of 48 units, the presence of free HCl, and an absence of lactic acid. The presence of hydrogen sulphide was noted by Boas and Heine.

Pain. Definite statements as to the presence or absence of abdominal pain are found in only 42 cases. In these pain of greater or less severity was present 35 times. In the remaining 7 cases no pain occurred. The pain was referred usually to the epigastrium or the umbilical region, and in many of the cases was described as very intense.

Tenderness. The presence or absence of tenderness is recorded but 17 times. It was present in 12 and absent in 5 of these cases.

Distention was present in most cases. Its absence was noted only 4 times. It affected chiefly the epigastrium and the region to the left of the umbilicus, but in a few instances it is described as having been almost altogether below the navel. In others it was general and globular. Fagge describes the distention as lying below a line running obliquely downward and to the right to the right iliac region.

In a few instances *muscular rigidity* was noted, but oftener its absence is recorded.

Constipation. In many of the reports no record of the state of the bowels can be found. In 14 cases, however, there was no passage either of gas or feces. In 9, on the other hand, diarrhœa existed. Often the symptoms are described only as being those of intestinal obstruction.

The *temperature,* except in cases in which the symptoms have developed in the course of febrile diseases, has been almost invariably normal or subnormal. In a few of the fatal cases there has been a moderate rise of temperature toward the end.

Thirst is described as intense in many of the cases, as might be expected, and complete suppression of, or great diminution in the amount of, the urine is frequently noted. This is not an invariable rule, however, for in 2 instances with persistent vomiting it is expressly stated that no diminution in the quantity of urine occurred. Indican was present in the urine in some cases.

Persistent hiccough was noticed in a few of the patients, as was also a terminal delirium. Severe muscular cramps throughout the body occurred in 1 case (Wright), but no instance of tetany is recorded.

Splashing sounds and fluctuation waves below the level of the umbilicus aided in the diagnosis in a considerable number of the cases.

Visible Peristaltic Waves. A notable feature of the physical signs has been the absence of visible peristalsis. Only 3 exceptions to this rule could be found. Baümler and Herrick each saw slight peristaltic waves over the stomach. Schultz also saw slight waves

on one day, but on the next, when the dilatation had increased, they had disappeared.

Next to the vomiting the rapid development of *collapse* is perhaps the most striking feature of the clinical picture. The sunken eyes, the pinched and livid features, the superficial breathing, and the small, empty, very rapid pulse suggest at once some grave abdominal lesion and serve to explain the common diagnosis of perforative peritonitis or intestinal obstruction.

Duration and Prognosis. Among the 102 cases collected there were 74 deaths (72.5 per cent.) and 28 recoveries. It seems very unlikely, however, that this represents the true ratio between the patients that die and those that recover. There are probably many instances of moderate grade of acute stomach dilatation which get well without being recognized or, at least, without being recorded. In 63 of the fatal cases the duration of the symptoms could be determined with reasonable accuracy, and was as follows: Less than twenty-four hours, 7 cases; one to two days, 11 cases; two to three days, 14 cases; three to five days, 16 cases; five to ten days, 7 cases; ten to sixteen days, 8 cases. In other words, the duration of the symptoms in 75 per cent. of the fatal cases was less than five days. The 2 shortest cases were that of Dickinson (three or four hours) and my own (three hours); the longest that of Kausch (sixteen days). In the patients that recovered the duration of the symptoms varied greatly. In a few postoperative cases these disappeared almost immediately upon change of posture or some other therapeutic measure, but in other instances the dilatation subsided only very gradually (in the course of weeks), and once, at least (v. Herff), a moderate degree of dilatation persisted.

Morbid Anatomy. The statements which follow are based upon an analysis of the records of 69 autopsies.

The most noteworthy feature of the postmortem picture is the enormous size of the stomach. In almost every autopsy protocol the extreme degree of dilatation is commented upon. Often the organ occupies almost the whole of the abdomen. In 1 instance it is described as reaching into the true pelvis. In a number of cases it extended to the symphysis pubis. Once at operation it was mistaken for an immense pancreatic cyst, and as such was evacuated and drained (W. H. Brown). Riedel describes its color as seen at operation as purplish red. In several instances, however, it was grayish or bluish white (Robinson, Fenger, MacEvitt). The distended stomach assumes in most cases a characteristic cylindrical form and is sharply bent into two unequal portions. The larger of these—the cardiac portion—extends almost perpendicularly downward, while the smaller and shorter pyloric limb extends upward and to the right, producing a sharp, angular bend in the lesser curvature and giving to the organ a somewhat V- or U-shape.

Among the whole 69 autopsies definite obstruction at the pylorus

was found only three times: once by tumor (Thomson, Case I), once by constriction by a band of mesentery (Riedel, Case III), and once by kinking from adhesions (Riedel, Case II).

The stomach wall is described as abnormally thin in 14 cases. In 3 instances (Albrecht, Case II; Müller, Cases I and II) the wall is mentioned as of normal thickness. In 1 case (Kundrat, Case III) it is described as "thick." In none of the other cases is the condition of the wall mentioned.

A histological examination of the stomach wall is recorded in only a small proportion of the cases. In 1 (Schultz) there were found hemorrhages into the muscular layer, which seemed much thinner than normal and in which the muscle bundles were in many places torn apart and widely separated. In Miller and Humby's case also the muscle fibers were found torn apart. In the few remaining cases, including my own, in which a microscopic examination was made, the musculature presented no appreciable change other than the thinning. The wall in several cases showed many minute hemorrhages in the mucous and submucous layers. In 2 cases (Stieda; Fraenkel, Case II) the mucosa was the seat of small superficial erosions. In 1 instance (Körte) there existed an area of necrosis in the fundus, with perforation of the wall. In a very few cases there were present the lesions of chronic gastritis.

Duodenum. A part or the whole of the duodenum was found dilated in 38 cases (55 per cent.). In almost all of the remaining ones no mention whatever is made of the condition of this part of the intestine, and, as in many of these the autopsy records are very scanty and incomplete, it appears altogether probable that in some of them a dilatation of the duodenum may have been overlooked or, if noticed, not recorded. It seems, therefore, safe to say that in quite two-thirds of the cases, at least, the dilatation is not confined to the stomach, but involves as well a part or the whole of the duodenum.

In 19 of the 38 cases in which the duodenum was dilated the dilatation stopped suddenly near its lower end, at the point where the duodenum passes behind the root of the mesentery, and definite obstruction existed here by the pinching of the gut between the tense mesentery and its contained superior mesenteric artery in front and the aorta and vertebral column behind. That the pinching of the duodenum by the tense mesenteric band is real and serious is abundantly proved by the autopsy findings in Baümler's case, which revealed, in addition to a greatly dilated stomach, a dilatation of the duodenum to the point where it was crossed by the root of the mesentery. At this place the gut was compressed and showed a sharply defined band of bright-red color 2 cm. wide, and corresponding to this ring a necrosis in the mucosa 1.5 cm. wide. Microscopically this band of necrosis was found to be deepest at its centre, where it reached almost to the submucous layer.

In 8 other cases the dilatation ceased at the lower end of the duodenum, but compression by the mesentery was not noticed. These cases are those of Box and Wallace (Cases II and III), Buzzard, Fenger, Meyer, Petit, Schultz, and Thomson (Case V). In Buzzard's and Petit's cases the dilatation was ascribed to a sharp kink at the duodenojejunal junction. In Schultz's case, in which the duodenum had a diameter of 9 cm., the compression at the lower end was thought to result from the weight of the greatly dilated stomach. Meyer suggests the same explanation in his case. It seems very probable from the descriptions that some of these 8 cases may have been instances of mesenteric obstruction.

Three times (Hood, Jessop, Kirch) the dilatation involved not only the duodenum, but the upper few inches of the jejunum as well. In 1 instance (Mahomed) the duodenum and "intestines generally" were dilated. In another case (Kausch, Case I) the first portion (superior limb) of the duodenum was enormously dilated, and at the junction with the descending portion was kinked at an angle of 180 degrees with this latter. In Balster's patient there was an extravasation of blood (of unknown cause) in the wall of the descending limb, which caused constriction of the lumen, with great dilatation above.

The state of the intestines below the duodenum is not noted in many cases; when it is mentioned, however, they are described as empty and collapsed. In only 1 instance (Mahomed) are they spoken of as distended. In almost every case of mesenteric obstruction the small intestine has been found collapsed and lying chiefly in the true pelvis.

THE MECHANISM OF ACUTE DILATATION OF THE STOMACH. From the time of Brinton this condition has been looked upon by most writers as primarily of paralytic nature. The absence in almost all cases of obvious obstruction at the pylorus, and the fact that a similar paralytic distention of the intestines is a not uncommon phenomenon after abdominal operations and in peritonitis, have served to support this view; as has also the experimental work of Carion and Hallion. In practising, for other purposes, section of the vagi at varying levels, these investigators noted that gastrectasis followed the operation. "After resection of both nerves above the diaphragm we have seen produced in the dog an enormous dilatation of the stomach and of that portion of the œsophagus innervated"—and they add: "If section of the vagus nerves is capable of engendering complete atony and permanent dilatation of the stomach, it is hardly disputable that effects of the same nature could be determined by paralysis or inhibition of the corresponding nervous centres without any previous alteration in the stomach itself."

Accepting the usual teaching that the vagi supply the motor impulses to the stomach musculature, while sympathetic fibers from

the dorsal cord, through the solar plexus and splanchnic nerves, carry inhibitory impulses to control such peristaltic movements, the 2 cases (mentioned under Etiology) in which injury to the head has been followed by acute gastric dilatation would seem to be illustrations of such central paralysis of the motor function; and the cases following injury to the dorsal spine might perhaps be looked upon as due to abnormal stimulation of the inhibitory nerves. In the same way the 5 cases which developed in the course of severe pneumonia (Box and Wallace, Herrick, Hood, Lehmann, Thomson) might, it is conceivable, result from the involvement of the vagus trunks in the inflammatory exudate of the posterior mediastinum. It happens that in 4 of the 5 cases there was involvement of both lower lobes, and in the fifth case consolidation of the right lower lobe, with extensive plastic pleurisy over the bases of both lungs—in other words, in all 5 cases the conditions were favorable for the extension of the inflammation to the neighborhood of the vagi. Unfortunately in none of the postmortem examinations of these cases was the question of the involvement of the vagi investigated.

While in a few of the cases it is possible, then, that the explanation of the sudden dilatation may lie in some disturbance of the nerve centres or nerve trunks, this probably does not hold good for most cases. In the great majority of instances the disturbing agent must act directly upon the stomach musculature or its terminal nerve filaments. It has been suggested that the excretion of chloroform by the stomach may explain the large class of postoperative cases (v. Herff). Albu in his case ascribed the paralysis to the absorption of toxins formed by abnormal fermentative processes in the stomach. In other instances blows over the stomach, mechanical injury during operation, local peritonitis, as well as overdistention, severe infections, rapid emaciation, etc., have been regarded as the cause of such paralysis.

The view that acute dilatation depends upon a primary paralysis of the stomach musculature has not been universally held, however. Robson concludes that an analysis of all the cases "would seem to point to a neuroparesis associated with spasm of the pylorus, and Pepper and Stengel also believed some of the cases, at least, to be obstructive, "the pyloric stenosis being due to spasm, the result of acute indigestion or hyperacid secretion."

The theory of pyloric spasm as an explanation for any considerable proportion of the cases seems untenable, in view of the facts that in most of the cases the vomitus contains bile and that in about two-thirds of the cases the dilatation involves also the duodenum.

Morris was disposed to look upon the excessive secretion of fluid ("acute gastrorrhœa") as the primary condition and the dilatation as secondary, but there seems to be little basis for such a view.

With the accumulation of cases of acute gastric dilatation associated with mesenteric constriction of the duodenum, the question has very naturally arisen whether most cases of dilatation might not be due to such obstruction of the duodenum. That many instances of dilatation have not shown this obstruction postmortem would not in itself disprove such a theory, since in the usual manipulation of the intestinal coils the condition might very easily be overlooked unless the possibility of its occurrence were borne in mind.

The whole subject of the mechanism of acute gastric dilatation has been carefully studied by Kelling, and while one may hesitate to accept all his conclusions, his work seems to throw some light upon a problem which at best is complex and puzzling. Kelling starts out with the assumption that, as a prerequisite to the production of acute dilatation, there must be some obstruction to the exit of the stomach contents (fluid and gaseous) *both* upward and downward, for otherwise the overdistention of the organ (by which alone, he thinks, acute dilatation can occur) will be prevented by vomiting and eructation or by the passage of the stomach contents into the intestines. In a series of experiments upon cadavers he found, by inflating the stomach through an opening in its anterior wall, that in a considerable proportion of cases the cardiac orifice was impervious to the passage of air from the stomach into the œsophagus no matter how great the pressure might be; in other cases air would pass only when the intragastric pressure was high, and in still others it passed so freely into the œsophagus that no considerable intragastric pressure could be secured. He found this valve-like closure of the cardia to depend upon certain anatomical relations between the fundus of the stomach and the insertion of the œsophagus. In such cases the cardia can be opened (from below) only by active contraction of bands of muscle fibers running from the œsophagus into the wall of the fundus, and if, by a weakening of these muscles from any cause or by a great increase in intragastric pressure, the active opening force fall below the pressure which maintains the closure of the cardia, any emptying of the stomach through the œsophagus is rendered impossible.

With the œsophagus securely closed by ligature Kelling found, further, by inflating the stomach, that in certain of the cases air passed freely through the duodenum, but that in a majority of instances obstruction occurred by the formation of a sharp kink in some part of the duodenum. Sometimes this kink formed at the junction of the superior with the descending limb, at the point of attachment of the ligamentum heptoduodenale, and above the papilla of Vater; in other cases it occurred below the papilla—usually at the junction of the descending limb with the inferior horizontal portion. The production of such kinks (the possible occurrence of which has long been recognized) seems to depend upon the firmness with which the duodenum is attached to the posterior abdominal

wall. In cases in which the gut is relatively loosely fixed it is able to alter its position sufficiently to prevent such kinking.

It is those individuals, Kelling thinks, who have the tendency both to valvular closure of the cardia and to the production of an obstructive kink in the duodenum who are liable, with overdistention of the stomach by gas or food, to the development of acute dilatation.

I have myself repeated Kelling's postmortem experiments in a series of 12 cases (adults dying of affections not involving the stomach or duodenum) with results which differ somewhat from those he obtained. In 7 instances very considerable distention of the stomach occurred before there was any leakage of air through the œsophagus, but such leakage always took place when the air pressure reached a certain height, which, measured by a water manometer, varied between 15 and 26 cm. In the other 5 cases air passed freely into the œsophagus and no distention of the stomach could be produced.

My results in the matter of duodenal obstruction were also somewhat at variance with those of Kelling. With the œsophagus ligated and the stomach inflated, obstructive duodenal kinks were seen in only 3 cases, and in each of these air passed the obstruction when the intragastric pressure measured 22 cm. or less by the water manometer. In each instance the kink formed at the junction of the superior with the descending limb. In 1 of these cases the air, after passing the kink at 20 cm. pressure, found further obstruction at the point of crossing of the root of the mesentery. In 4 other instances obstruction occurred not in the duodenum but at the pylorus, which was tightly closed and required a pressure of from 15 to 25 cm. to overcome it. After passing the pylorus no further obstruction was encountered.

The conditions existing in all such postmortem experiments must of necessity be so entirely different from those which obtain during life, however, as to make it very doubtful indeed if the results so obtained can safely be applied to the explanation of the phenomena of acute dilatation.

More significant, I think, are certain animal experiments made by Kelling and verified by Braun. They found that in dogs upon which a gastrostomy had been done, and which had had time to recover from the effects of the operation, it was impossible to produce a condition of acute dilatation by inflating the stomach, for whenever a certain degree of distention was reached a vomiting reflex was excited and the stomach was emptied by vomiting and eructation. When, however, the animal was narcotized the stomach could be distended to the point of bursting without the least escape of air through the œsophagus and without any reflex attempt at regurgitation or vomiting.

That the development of acute dilatation of the stomach may

be favored by anatomical peculiarities which lead to obstruction both at the cardia and in the duodenum seems altogether likely, but that such double obstruction is *necessary* to its production (as Kelling believes) seems to be clearly negatived by the fact that in many instances of typical and extreme dilatation vomiting and eructation have been present throughout the whole course of the disease.

While there is good reason then to doubt that obstruction at the cardia, or failure of the vomiting reflex, is essential to the development of acute dilatation, there is much evidence to show that obstruction below the stomach is present in very many of the cases and that it plays a role of considerable importance in the production of such dilatation.

Among the 69 autopsy reports studied an associated dilatation of the duodenum was noted 38 times (55 per cent.), and of these 38 cases 25 showed some form of obstruction below this dilatation (see Morbid Anatomy). In some of the remaining 13 cases the records are very incomplete and unsatisfactory, and it is impossible to say whether obstruction existed or not. But even if none of these cases is included, and if no allowance is made for the fact that occlusion by kink or by pressure might very easily be overlooked at the postmortem table, there still remains the fact that in 36 per cent. of all the autopsies definite obstruction was found in some part of the duodenum.

Further evidence of the frequency and importance of obstruction below the stomach is to be found, it seems to me, in the fact that the quantity of fluid vomited or removed from the stomach has been, in most cases, so enormous, and that this excessive amount of fluid can be most satisfactorily explained (as Müller has shown) by the assumption of some obstruction high up in the intestines by which the usual reabsorption of the (normally) large amount of fluid secreted by the stomach, pancreas, and liver is prevented. An analysis of the 25 cases in which some form of duodenal occlusion was shown to exist gives the following results: In 19 instances the dilatation ended at the point where the duodenum is crossed by the root of the mesentery, and the obstruction was ascribed to constriction by the tense mesentery. In 2 other cases (Meyer, Schultz) the dilatation extended to about the same point, but the obstruction was believed to be due to pressure of the displaced pyloric portion of the stomach. Twice (Buzzard, Petit) the occlusion was caused by a sharp kink at the duodenojejunal junction; once by a kink at the junction of the superior with the descending limb of the duodenum (Kausch), and once by an extravasation of blood (of unknown cause) between the mucous and muscular layers of the wall of the descending portion of the duodenum (Balster).

Mesenteric Obstruction of the Duodenum. The frequency with which mesenteric compression of the duodenum has been found

associated with acute dilatation of the stomach and duodenum demands that this remarkable condition shall now be discussed in some detail. I have collected 18 fatal cases from the literature (Albrecht (2), Baümler, Binswanger, Kausch, Kelynack, Kundrat (3), Lehmann, Müller (2), Philippe, Robinson, Schmorl (Kelling), Schnitzler, Stieda, Walzberg).[3]

In addition to these fatal cases there are, among the cases of acute gastric dilatation which recovered, several (Bäumler, Müller, Robson, Schnitzler, Walzberg) in which the clinical picture was that of mesenteric obstruction of the duodenum, and in which a cure was effected by treatment (chiefly postural) directed toward the relief of the supposed mesenteric compression.

In view of the presence of bile and a diastatic ferment in the stomach contents and of the result of postural treatment in Baümler's second case it can hardly be doubted that the diagnosis of mesenteric obstruction was correct. The other cases referred to are scarcely less convincing.

In looking over the cases of mesenteric obstruction cited it will be seen that the condition, in its etiology, symptoms, duration, and prognosis, does not differ from that of acute gastric dilatation in general. Even the characteristic symptom of bilious vomiting has been present in most cases of acute dilatation of the stomach in which no mesenteric compression was noted.

Among the 69 fatal cases examined mesenteric obstruction was thought to exist 19 times (27.5 per cent.). In 19 other cases, as has been said, dilatation of the duodenum was found at autopsy, and, although in some of these instances other causes for the dilatation were discovered, in a number of them it seems very probable that mesenteric compression may have been present. If to these are added the several cases with recovery in which there is good reason to believe that the same condition existed, it becomes evident that obstruction of the duodenum by the mesentery must be regarded as a factor in the development of a large proportion (perhaps from one-third to one-half) of all the cases of acute gastrectasis.

The subject of the production of this form of duodenal incarceration has been carefully studied by Albrecht, who points out that the terminal portion of the duodenum, where it passes behind the root of the mesentery and lies upon the vertebral column and aorta, has under normal conditions not a round but a distinctly flattened circumference, owing to the pressure of the overlying mesentery and its contained superior mesenteric artery. This normal constriction can readily be seen in a cadaver in the dorsal position, and if a finger is passed into the duodenum and at the same time gentle traction downward is made upon the mesentery, the con-

[3] A brief synopsis of these cases will be found in the Trans. Assoc. Amer. Physic., 1906, xxi, 601.

striction becomes more distinct and is very evident to the examining finger. If now traction upon the mesentery is made in the direction of the axis of the pelvis—that is, downward and backward—the constriction may be converted into complete occlusion. With the small intestine lying altogether or chiefly in the pelvis, traction would be made upon the mesentery in just the direction needed to produce such occlusion. The presence of the small intestine in the true pelvis seems then to be a *sine qua non* to the production of such mesenteric occlusion of the duodenum, and this view is borne out by the autopsy findings of the recorded cases. In order that the intestine may make its way into the pelvis and there exert traction upon its mesentery, it is necessary that it contain little or no gas and that the mesentery be of suitable length—long enough to allow the intestine to hang in the pelvis without being supported by the pelvic floor.

It is possible to demonstrate on the cadaver, as Albrecht and others have done, that traction on the mesentery in the direction of the axis of the pelvis may produce obstruction in the duodenum which will be impervious to water under considerable pressure. Box and Wallace, however, conclude from their experiments that the great distention of the stomach and the obstruction in the duodenum that can be produced in cadavers, in the dorsal position, by water pressure, depend not upon constriction by the root of the mesentery, but rather upon the direct pressure of the heavy stomach upon the duodenum where it crosses the lumbar vertebræ.

This question I have attempted to study in a series of 10 adult subjects. With the bodies in the dorsal position and the organs in place, the small intestine was removed and the mesentery gathered up into a mass and fastened to a cord which was passed into the pelvis and out through the anus and was allowed to hang free. To this different weights could be attached. The stomach and duodenum were then filled through the œsophagus, by a small tube of water from the tap, and the pressure necessary to overcome the duodenal obstruction estimated by connecting the tube with a mercury manometer.

The results differed greatly in the different cases. In 3 instances the obstruction seemed to be due almost entirely to the weight of the distended stomach upon the end of the duodenum, and with this raised very little interference with the flow of water into the jejunum was produced by a weight of 500 grams or even 1 kilogram attached to the mesentery. In each of these 3 cases a certain degree of gastroptosis existed. In the other cases a load of 500 grams (the approximate weight of the empty small intestines) produced an obstruction, to overcome which required a water pressure varying from 10 to 48 mm. of mercury. In some of these cases the stomach gradually distended to a point where it lay

upon the duodenum, and by its weight increased somewhat the obstruction caused by the tense mesentery. In other instances the dilated stomach did not rest upon the duodenum and exerted no influence whatever upon the mesenteric obstruction.

The conclusion seems justified that in a certain proportion of normal individuals a pull upon the mesentery approximating, in direction and force, that which might be exerted by the empty small intestines hanging in the true pelvis can produce obstruction at the lower end of the duodenum which will require very considerable force to overcome.

The conditions essential to or which favor mesenteric obstruction may for convenience be divided into two groups: those which aid in the descent of the intestine into the pelvis, and those which favor the more complete occlusion of the duodenum.

For the entrance of the intestine into the pelvis three things, at least, seem necessary: dorsal decubitus, an intestine nearly or quite empty of gas and feces, and a mesentery of suitable length—long enough to permit the intestines to slip into the pelvis, and yet not so long that they may be supported by the pelvic floor.

It is possible that the frequency of such obstruction after operation (in 8 of the 19 cases) may depend in part upon the fact that at such times the intestines have been kept empty by fasting, purges, enemas, etc.

Other conditions which seem to favor the descent of the gut into the pelvis are chiefly those which disturb the normal equilibrium of the intra-abdominal pressure. Kundrat believed that a lax, flabby abdominal wall acted so by failing to hold the intestines in their usual position. Lehmann, in his case, which developed in the course of a double lower-lobe pneumonia, suggests that the weight of the hepatized lungs and the violent coughing efforts may have aided in forcing the small intestine into the pelvis. In the remarkable case of Schmorl the symptoms followed immediately upon a violent paroxysm of laughing. In one of Kundrat's cases they suddenly appeared in a typhoid-fever convalescent who had left his bed for the first time.

The duodenum is rendered more liable to serious compression, Schnitzler believes, by any unusual prominence (lordosis) of the lumbar vertebræ, or by an abnormally low position of the last portion of the duodenum, since the vertebræ become increasingly prominent as they descend.

Increased lordosis existed in 2 of the recorded cases (Kausch, Robinson), as well as in several other instances of acute gastric dilatation in which no mesenteric obstruction was recognized.

The same result was brought about in Philippe's case by a mass of clotted blood which lay behind the terminal portion of the duodenum and pushed it forward. He also demonstrated experimentally that by the injection of a quantity of tallow behind the

lower part of the duodenum complete arteriomesenteric obstruction could be produced even with the small intestine not in the pelvis.

The line at which the third portion of the duodenum crosses the lumbar vertebræ varies much. Fawcett and Blachford, in studying this point recently, found the position of the lower border of the duodenum to vary between the upper border of the second lumbar vertebra and the disk between the fifth lumbar and the sacrum. Most commonly it crossed the third lumbar vertebra. In general the point of crossing was lower in females than in males. In view of the fact that the anterior curve of the lumbar vertebræ reaches its maximum at the fourth vertebra, it is obvious that a duodenum which lay upon the fourth vertebra would be more liable to serious compression by the mesentery than would one which crossed, say, the second vertebra. There has been some differences of opinion as to whether the constriction of the duodenum is caused by pressure of the whole root of the mesentery or chiefly only by the superior mesenteric artery which runs in it. The frequent use of the term "arteriomesenteric obstruction" indicates that the artery has often been looked upon as playing an important role in the production of the obstruction, and there can be no doubt that to the examining finger in the duodenum, with traction upon the mesentery, the most resistant portion of the constricting band is the tense, cord-like strand which represents the artery; but, on the other hand, in Baümler's fatal case the band of hyperemia and necrosis in the duodenum corresponded in width and position to the whole root of the mesentery and not to the artery alone.

From a consideration of the conditions just enumerated it is not difficult to see how a transient occlusion of the duodenum might occasionally occur; but why such an occlusion should become a permanent, unyielding obstruction, with its train of violent symptoms and usually fatal outcome, is, as Albrecht has pointed out, by no means easy to explain. It seems very unlikely that such a pinching of the duodenum should always result in complete and permanent incarceration. It is more natural to suppose that it sometimes produces only a temporary occlusion which passes unrecognized. What is it then that occasionally renders such an obstruction permanent and insurmountable?

The almost constant presence, in the fatal cases, of an enormously dilated stomach has led to the very general belief that this is the factor of chief importance in the production of a permanent incarceration. By the rapid increase in the size of this organ the intestine would tend to be crowded more and more into the pelvis, and, once there, would be prevented from escaping. At the same time the weight of the heavy stomach upon the mesentery would be likely to render futile every effort on the part of the duodenal and gastric musculature to overcome the obstruction.

While there is general agreement that the greatly enlarged stomach is of much importance in rendering the incarceration more complete and permanent, there is still a sharp difference of opinion as to whether the dilatation of the stomach or the obstruction of the duodenum be the primary act in the vicious circle by which the dilated stomach increases the duodenal obstruction, and this latter in turn augments the dilatation of the duodenum and the stomach.

Von Herff, Stieda, and Neck believe the dilatation of the stomach to be always primary and the mesenteric constriction to be purely a secondary happening. On the other hand, Müller and Lehmann regard the duodenal obstruction as of prime importance and the first act in the chain of events.

That this latter view is correct, for some cases at least, seems altogether probable from the fact that in 2 of the cases of mesenteric obstruction (Kundrat, Case II; Philippe) no mention whatever is made in the autopsy reports of any dilatation of the stomach. Also in such cases as that of Schmorl, in which the symptoms followed directly upon a violent paroxysm of laughing, it seems probable that the trouble began with the sudden constriction of the duodenum by the mesentery.

On the other hand, it is easy to see how a considerable dilatation of the stomach, either acute or chronic, might favor the production of mesenteric obstruction, and, when this has occurred, prevent its spontaneous recovery. Albrecht believes that in many of the instances of apparently acute gastrectasis there has been a preexisting chronic dilatation which has converted a transient mesenteric constriction of the duodenum into a permanent and complete obstruction, and that this, in turn, has brought about a sudden increase in the gastric dilatation with its train of alarming symptoms. Unfortunately for this theory there is little evidence in either the clinical or the autopsy records to support the idea that chronic gastric dilatation is a frequent antecedent of mesenteric obstruction.

Chronic Mesenteric Obstruction of the Duodenum. Kundrat and Glénard held that a persistent, incomplete obstruction of the duodenum by the root of the mesentery was not uncommon and led to a gradual dilatation of the duodenum and stomach. Albrecht cites 2 cases which he thinks may have been instances of this condition, and Robinson asserts that in the course of several hundred postmortem examinations he has met with fifteen or twenty examples of gastroduodenal dilatation due to such incomplete obstruction.

Nothing is known of the clinical manifestations of such chronic mesenteric obstruction, and, in view of its possible importance, it is very desirable that the attention of surgeons be directed to the need of careful examination of the lower part of the duodenum and the mesenteric root in operations affecting that part of the abdomen. It is quite possible that some of the instances of duodenal dilatation, to the frequency of which operators in this country

(Finney, Mayo, Ochsner) have recently called attention, may be due to such chronic mesenteric obstruction.

DIAGNOSIS. It is interesting, in looking over the records of the reported cases of acute gastric dilatation, to note that whereas the first case seen by most of the writers has passed unrecognized, subsequent cases observed by the same men have almost always been correctly diagnosticated during life. In other words, the condition is usually not difficult of recognition if the possibility of its occurrence be but held in mind. Intestinal obstruction and perforative peritonitis have been the conditions with which it has most frequently been confused. Once at operation the hugely dilated stomach has been mistaken for and treated as a pancreatic cyst. In some of the postoperative cases the persistent vomiting has been looked upon as only an exaggerated form of the usual postnarcotic vomiting.

The sudden onset of severe and continued vomiting, and especially the vomiting of very large amounts of bilious, non-fecal, fluid, should always suggest the possibility of acute gastric dilatation. A normal or subnormal temperature, rapid emaciation and collapse, obstinate constipation, and abdominal pain, tenderness and distention are other very common symptoms; but it must be emphasized that any one, or most, of these may be lacking in a given case. In two of the recorded cases vomiting has been absent throughout. In a few instances there has been neither pain, tenderness, nor distention. Occasionally diarrhœa has replaced constipation. The diagnosis is made definitely by the demonstration of the greatly dilated stomach by means of careful physical examination and especially by the use of the stomach tube. The existence of mesenteric obstruction of the duodenum is made probable by the demonstration, in the contents of the dilated stomach, of bile and of pancreatic juice, by the absence of distinctly fecal vomiting, and by the satisfactory results of postural treatment. It is possible that an examination of the pelvis through the rectum or vagina might show there the mass of collapsed intestine. Kelling suggests, as a means of determining whether or not complete obstruction exists at the lower end of the duodenum, the use of a high injection of a large quantity of concentrated (6 per cent.) salt solution. The usual effect of this is to empty the small intestine as well as the colon, and the presence or absence of fresh bile in the returned fluid would determine the question as to whether or not the duodenum was pervious.

TREATMENT. The effectiveness of treatment in acute dilatation of the stomach will depend, in large measure, upon the time at which it is begun. When the stomach has become dilated to its maximum and the patient has reached a state of extreme prostration and collapse, treatment has often been unsatisfactory and unavailing. On the other hand, when the disease has been recognized before

this terminal stage was reached the results of treatment, in most cases, have been very gratifying.

The first step in treatment, whatever the cause of the dilatation may be, is the prompt and complete emptying of the stomach by means of the stomach tube. Owing to the often enormous size of the organ and the flaccid state of its walls, this is not always a simple task. The tube must be made to reach the most distant and dependent parts of the stomach, and changes in the patient's posture may be necessary in order that all the contents may be reached. This emptying of the stomach should be repeated at regular intervals, usually several times in the twenty-four hours. Food or drink by mouth should be absolutely interdicted. The excessive loss of fluid should be met by large saline enemas or by hypodermoclysis. Nutrition should be maintained as well as possible by rectal feeding.

In a considerable number of the cases the above-mentioned treatment has been all that was needed to effect relief of the symptoms and gradual recovery, but in view of the fact that some form of duodenal obstruction has been shown to exist in 36 per cent. of the fatal cases, and has probably been present in many others, the likelihood of such obstruction has to be considered in every case. If such obstruction is due only to a duodenal kink or to the weight of the dilated and overloaded stomach, the mere emptying of the stomach and the keeping of it empty may suffice to relieve the obstruction. It has been shown, however, that three-fourths of all the cases of duodenal obstruction have been caused by constriction by the root of the mesentery, and for the relief of such obstruction something more than the emptying of the stomach is needed. Schnitzler was the first to treat successfully a case of acute gastric dilatation on the assumption that the symptoms were due to mesenteric obstruction. The patient was changed from the dorsal to the belly position and all the symptoms promptly ceased. After several hours he was able to resume the dorsal position. The abdominal distention had disappeared, vomiting did not return, feces and flatus passed freely, and the patient made a good recovery.

In Baümler's case (already cited) the patient was kept in the knee-elbow position for a quarter of an hour in each two hours, the rest of the time lying on his belly. The symptoms disappeared promptly and the patient recovered.

The experience of Müller (Case IV) was even more striking. In this patient vomiting persisted in spite of lavage and elevation of the pelvis. It ceased immediately, however, when the belly position was taken. After two hours a dorsal posture was tried, but vomiting began again at once. The patient lay on her belly through the night and slept well. Next day she was able to take and retain food in this position, but every attempt to lie on her back was followed by vomiting. On the following day, however, she could lie on her back comfortably and thereafter had no further trouble.

Walzberg records a very similar experience (Case II). Lavage having been of no avail, the patient was turned upon his right side and three hours later upon his left side. Vomiting ceased immediately. Two days later, on attempting to lie upon his back, nausea returned and the lateral position had to be resumed. The patient made a good recovery. In one of Robson's patients (Case IV) the symptoms were relieved by keeping her in the belly position.

These results are so striking that is seems but fair to give every case of acute dilatation of the stomach the benefit of the doubt, and to try the effect of such postural treatment as seems most likely to displace the intestine from a position in the pelvis and to relieve a possible mesenteric constriction of the duodenum.

It should be noted, however, that in 1 case (Borchardt) the symptoms seemed to be made worse by the use of the belly position.

The relief of acute gastric dilatation by operation has been attempted a number of times. In 7 instances (W. H. Brown, Box and Wallace, Appel, Hoffmann, Jessop, Kirch, Wright) the stomach was opened and evacuated, but none of the patients recovered. Gastroenterostomy has been performed twice (Kehr, Körte), and both times unsuccessfully. Petit found at operation a sharp kink at the duodenojejunal junction. This he relieved by lifting up the jejunum and stitching it to the transverse mesocolon. The symptoms disappeared and the patient recovered. The advisability of a gastroenterostomy is open to serious question. There is quite general agreement that it should be employed, if at all, only as a last resort. In most cases it is unnecessary, and in those patients who have resisted all other methods of treatment it is doubtful, Borchardt thinks, if any good can be accomplished by operative measures.

SUMMARY. Acute dilatation of the stomach is a disease of considerable clinical importance and is deserving of wider recognition. It develops under a great variety of conditions, but is especially frequent after operations with general anesthesia. In a majority of the cases there has been an associated dilatation of the duodenum.

The mechanism of acute gastric dilatation is not yet clearly understood, but in a large proportion of cases (perhaps one-half) the dilatation is associated with, and seems to result from, some form of obstruction in the duodenum.

Much the commonest cause of such duodenal obstruction is the constriction of the lower end of the duodenum between the root of the mesentery, which crosses in front of it, and the vertebral column. Such constriction can occur only when the mesenteric root, with the superior mesenteric artery which runs in it, is stretched tightly across the duodenum; and this is possible, apparently, only when traction is exerted by the small intestine hanging over the brim of the pelvis. The development of mesenteric constriction is favored, therefore, by whatever facilitates the entrance of the

small intestine into the true pelvis (dorsal decubitus, a mesentery of suitable length, an empty and collapsed state of the gut, etc.), and whatever renders the duodenum more liable to compression (increased lordosis of the lumbar vertebræ, low position of the duodenum, etc.). Great dilatation of the stomach would doubtless increase the liability to mesenteric obstruction by crowding the intestines into the pelvis, and would tend, by preventing the escape of the gut from the pelvis, to render such obstruction, when once formed, more complete and permanent.

Whether the dilatation of the stomach or the mesenteric obstruction of the duodenum constitutes, usually, the first step in the vicious circle by which both conditions are made worse is still uncertain, but there is little doubt that in some cases, at least, the duodenal obstruction is primary.

The symptoms and physical signs of acute gastric dilatation are usually so distinct that the diagnosis should not be difficult if the possibility of such occurrence be but remembered.

In spite of the high mortality (72 per cent.) among the reported cases, there is much evidence to show that the disease can usually be controlled and cured if the diagnosis be made and suitable treatment begun before complete collapse of the patient has occurred.

The following list of 82 cases,[3] in addition to the 2 cases reported herewith and the 18 cases of mesenteric obstruction already cited, constitutes the material upon which the present study is based:

Albu, Appel, Balster, Baümler, Bennett, Bettmann, Boas, Borchardt, Box and Wallace (3 cases), Braun (5 cases), Broadbent, H. H. Brown, W. H. Brown, Buzzard (Perry and Shaw), Dickinson, Dyson, Edmunds, Erdmann, Fagge (2 cases), Fenger, Fisher, Fränkel (2 cases), Goodhart (4 cases), Heine (2 cases), v. Herff (3 cases), Herrick (2 cases), Hoffmann, Hood, Hunter, Jessop, Kausch, Kehr (2 cases), Kelling, Kirch, Körte, Lieutaud, MacEvitt, Mahomed, Meyer, Miller and Humby, Morris (2 cases), Müller (2 cases), Petit, Riedel (3 cases), Robson and Moynihan (4 cases), Rosenheim, Schnitzler, Schultz, Simon, Thomson (5 cases), Valsalva, Walzberg, Willett, Wright (2 cases).

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THE OPERATIVE TREATMENT OF FRACTURES, ESPECIALLY OF THE LONG BONES.

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When a surgeon is called upon nowadays to treat a patient with a fractured femur, for example, the problem which immediately confronts him is whether to operate or not to operate. There was a time long gone by when the question of operation in such cases never arose unless it was a question of amputation or resection; operation for the purpose of putting the broken fragments in proper relationship with one another was not considered, since the proper adjustment of the fragments was thought to be done by extension, counterextension, and manipulation. The Röntgen rays have shown that most fractures of long bones set in this way have resulted in shortening due to overlapping of the fragments.

The question may be asked, Why should we operate on fractures which are almost certain to get well without operation? The answer is, For several reasons: (1) To prevent deformity of a limb, especially shortening, which is of the greatest importance in the lower limbs; (2) to prevent loss or impairment of function, as of pronation or supination; (3) to obviate delayed union or ununited fracture; (4) to give opportunity to repair the soft tissues—nerves, muscles, and bloodvessels; and (5) because, as a rule, it is the only way to get a perfect result. It is now generally agreed that for a fractured patella or olecranon the operative is the best treatment.

I believe that perfect adjustment in fractures of the long bones is seldom accomplished without operation, except in green-stick fractures and some transverse fractures in which the fragments may be only partially displaced and have not overridden, as in some Colles fractures. It is also often impossible to ascertain, after a supposed reduction, whether or not apposition has been obtained. In the case of a broken femur surrounded by muscles from two to four inches in thickness, who by palpation can tell anything about the relations of the fragments? We resort to measurement: a mistake of one-half to three-fourths of an inch may easily be made on

account of the broad or flat bony prominences between which we measure. The grating of bony fragments and the result of measurement may indicate complete reduction, but its stability cannot be depended on: the fragments may be touching each other over the smallest fraction of an inch, and this contact may be broken at any moment by the slightest movement of the limb, and shortening may be reproduced. By exposing the site of the fracture by incision, and then having extension and counterextension made while I manipulated the naked ends of the fragments, I have repeatedly demonstrated the great difficulty of reducing by extension and counterextension fractures of the humerus, radius, ulna, femur, and tibia in which the ends of the bones overlapped. In transverse fractures it has often been necessary to bring the ends out of the wound, in partial contact with one another, making an angle like the rafters of a roof, then by straightening the limb the ends of the fragments would be brought in full contact with each other. In oblique fractures, even with the aid of the lion-jawed and other bone-holding forceps, I have sometimes been unable to get perfect reduction and have had to fasten the fragments together with a fourth of an inch shortening. In a patient with fracture of the middle of the shaft of the femur treated for a few days on the double inclined plane, operation revealed an overriding of two inches and a separation of the fragments from each other by muscular tissue one inch in thickness.

It is the opinion of many that Buck's and other kinds of extension can correct the shortening. It may diminish the shortening, but in the majority of cases I believe it cannot correct it fully. I treated a man, sixty years old, with a fracture in the upper third of the shaft of the femur, on a double inclined plane, with extension in a line with the femur with a weight of sixty pounds, without getting complete reduction. The method by operation was explained to him, but he preferred the other and made a good recovery, with one inch and a half shortening of the femur.

If there is anything in the theory that union of bone is hindered or prevented by the intervention of soft tissues, too much motion, or lack of accurate approximation, operation properly performed surely must often prevent delayed union. I say properly performed, because otherwise it seems possible to increase the danger of delayed union. For example, too extensive detachment of the soft parts with the periosteum from the fragments may cause necrosis. In some cases in which union has taken place in bad position and it has been necessary to operate, delayed union may result. The resources of the tissues seem to have been exhausted in the formation of the callus for the first union; whence they are unequal to the second task imposed upon them.

The dangers of the operative method must be carefully considered. That means the dangers which come by reason of the operation,

and not those which attend fractures treated in other ways: (1) Anesthesia. This is not peculiar to the method by operation, but is in general use in the treatment of fractures. (2) Fat embolism. As shown by Connell and others, this occurs in nearly all fractures of large bones containing much fat, and is probably dangerous only when the amount of fat taken up by the capillaries is large—a condition likely to be brought about by much manipulation of the fragments, and therefore equally as likely to result from efforts to reduce a fracture by the blind as by the open method. (3) Extensive detachment of the periosteum and other soft parts must be avoided as already mentioned. (4) Infection. This is the chief danger, as the others mentioned are common to any method in which anesthesia is used, and in modern surgery this should not be great.

TECHNIQUE. Of the various means used to hold the fragments of bones together, such as plates, screws, nails, ivory pegs, bone ferrules, animal sutures, and wire, I believe the wire the best in a large majority of cases. It is less bulky, it can be applied with much less injury to the soft parts than some of the others—the metal plates, for example—and its action in holding the bones together continues longer than any of the other methods except the bone ferrule. The nails and screws soon cause softening of the bone in which they are embedded, and the bone ferrule is not satisfactory according to my limited experience. It is not always necessary to wire the fragments or to use sutures. Transverse fractures, once perfectly reduced, remain in position by the use of splints, but it is safer to wire them. Kangaroo tendon, silk, and heavy catgut may do in some cases, but as a rule wire is better, because it is stronger and is not absorbed too soon. No matter how much care may be used to keep the ends of the bones together, some force, as the contraction of muscles, will tend to displace them, and this force may continue to act after animal sutures have been absorbed. Recently I have been using iron wire. It has the advantages over silver wire of being much stronger and cheaper, it does not seem to irritate the tissues or to be more often followed by suppuration than silver wire, and I believe it is possible in time for the iron wire to corrode away and disappear.

Wire may be used in several ways: (1) In transverse fractures each fragment is drilled through at right angles and two strands of wire are used (Fig. 13). (2) Only one hole is drilled in each fragment and only one loop of wire is used (Fig. 6). (3) The drill-holes do not pass through the bone, but only enter the medullary cavity (Fig. 5). The first of these methods gives the greatest security against displacement. (4) In oblique fractures the fragments may be drilled through while in position, the wire passed through, and then carried several times around the fragments. (5) The wire may simply be carried several times around the

fragments after adjustment, without drilling (Figs. 2, 3, and 4), or it may be carried around the fragments in position at two or more points (Fig. 2).

For carrying wire around bones so as to injure the soft parts as little as possible, I have had a strong, full-curved needle made in three sizes. For holding the fragments in position while drilling or wiring, Foraboeff's bone-holding and the lion-jawed forceps are indispensable. For drilling the bone a drill with a handle like a gimlet is the most satisfactory. All hemorrhage having been arrested and the wound closed, the best splint is plaster-of-Paris, but a window must be cut—through which one may observe the progress of the wound in the soft parts.

CASES. In my note-books I find histories of 102 cases of fracture in which I have operated, as follows: Superior maxilla 4, inferior maxilla 12, clavicle 5, humerus 10, radius and ulna together 5, radius alone 1, ulna alone 10, femur 13, patella 20, ruptured patella tendon 1, ruptured quadriceps extensor 2 (these three cases are placed next to fractures of the patella, to which they are nearly allied), tibia 16, and fibula 3. There were two deaths, both after operation on the neck of the femur; they will be considered later.

Superior Maxilla. The fractures of the superior maxilla were bilateral and complicated with fracture of the bodies of the palate bones and of the pterygoid processes of the sphenoid, the line of fracture passing through the superior maxillæ from the front backward through the nasal fossæ and the antra of Highmore, above the palate processes, through the body of the palate bones and the pterygoid processes, so that the entire alveolar arch and palate dropped slightly and were freely movable. In one case the two maxillæ and palate bones were separated from their fellows in the median line. The causes of these fractures were street railway accidents in 2, and blows across the front of the upper jaw in 2. There was no difficulty in obtaining union, though one was complicated with an abscess of the antrum of Highmore.

Lower Jaw. The fractures of the lower jaw were all through the body of the bone and the alveolar process, most of them oblique; the transverse fractures were usually treated with bandages and splints only. The line of fractures should be exposed by an incision along the lower border of the body of the jaw and the soft parts stripped off until the bone is exposed on each side of the line of fracture sufficiently for drilling a hole. Care should be taken not to injure the mental nerve at its exit from its foramen, nor the branches of the cervicofacial division of the seventh nerve near the angle of the jaw. It may be necessary to ligate and divide the facial artery. The holes in the fragments should be drilled as near to the line of fracture as is safe, and low enough not to injure the teeth roots or the inferior dental nerve. The wire should then be introduced, twisted until the fragments of bone are in apposition, the ends cut

off, and the twisted part turned beneath and to the inner side of the bone. The teeth should be wired, if practicable, passing the wire around the teeth two teeth distant from the line of fracture, twisting the wire on the outer side of the teeth, and turning the end down against the gum so that it will not irritate the lip (Fig. 1). These twelve patients all made good recoveries.

Clavicle. The fractures of the clavicle, five in number, were all treated by incision, exposing the parts, putting the fragments in place, and holding them by wrapping them with catgut, kangaroo tendon, or silver wire. This was done by means of a large, full-curved needle, carrying the thread around from three to eight to ten times. Care was taken to separate the muscle attachment as little as possible, both to avoid necrosis and also to afford tissue which would prevent the thread which is passed through it from slipping. In no case was it necessary to drill the fragments. The results were all good, and there was no shortening (Figs. 2, 3, and 4).

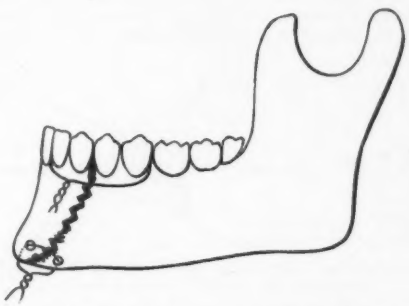

FIG. 1.—Fracture of left side of the lower jaw, showing the wires in place—one through holes drilled in the lower part of the body of the jaw, the other around the teeth.

Humerus. Of these, 10 were operated on: 2 of the neck, 1 of the middle third of the shaft, 3 supracondylar, 2 T-fractures, and 2 condylar fractures. One of the neck fractures (Case VIII) occurred in a man, twenty-five years old, who fell from a step-ladder a height of about four feet, and struck on his right shoulder. Examination showed swelling and the projection upward and inward, in front of the acromion process, of the upper end of the lower fragment, as in epiphyseal separation; a diagnosis of fracture of the anatomical neck was made. The parts were exposed by an incision from the anterior part of the acromion process downward in line with the humerus, splitting the fibers of the deltoid to the outer side of the long head of the biceps and the attachment of the pectoralis major, cutting and tying a few branches of the circumflex arteries, and exposing the circumflex nerve, but pushing it out of the way. On retracting the soft parts the fracture was exposed. The principal

line of fracture ran from the anatomical neck in front downward, inward, and backward, for an inch and a half obliquely, through the bone, separating the tuberosities from each other—the greater tuberosity remaining with the upper fragment, the lesser forming the upper end of the lower fragment. A fragment about half an inch square was broken from the greater tuberosity, but was held in position by the fibrous tissue. The joint was not opened. The displacement was easily reduced by traction on the arm; a hole was

FIG. 2.—Fracture of the left clavicle at the junction of the middle and the outer third, with the production of three fragments. These were adjusted and held in place by four kangaroo ligatures encircling the fragments; two of the ligatures were placed obliquely. (Case 1, book 2, page 49.)

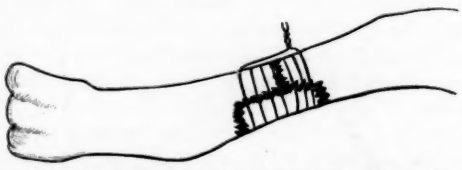

FIG. 3.—Fracture of the left clavicle (three pieces), showing the silver wire carried around the fragments. (Case IV, book 6, page 130.)

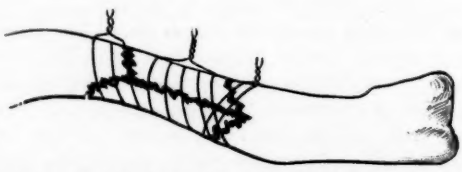

FIG. 4.—Fracture of the right clavicle (the middle third broken into four fragments), showing wire at the ends passed obliquely around the fragments and through the muscular attachments to prevent slipping. (Case V, book 6, page 136.)

drilled in each fragment into the medullary cavity, and a piece of silver wire was put in and twisted, thus holding the fragments in exact apposition (Figs. 5 and 6). The wound was closed without drainage and the arm was bound to the side with a sling for the forearm. There was primary union of the soft parts, and forty-five days later there seemed to be bony union with good result—motion, shape, etc., being normal. A skiagram showed the parts in normal position.

Case IX was a compound transverse fracture of the surgical neck of the left humerus in a boy eighteen years old. The wound in the soft parts was two inches below the shoulder-joint and a little to the outer side of the anterior surface. The wound was enlarged above and below, about in line with the middle of the acromion process along the outer surface of the humerus, splitting the deltoid, securing the branches of the circumflex arteries, and avoiding the nerve. There was overlapping of more than an inch—the lower fragment lying to the outer side of the upper fragment. The line of fracture was transverse, with a short spicule attached to the inner side of the lower fragment. There was considerable difficulty in getting the ends together in spite of traction and the use of bone-holding forceps. Once put together there seemed to be no tendency to displacement, but a hole was drilled in each fragment from side

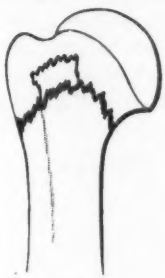

FIG. 5

FIG. 6

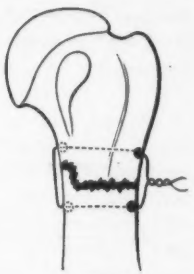

FIG. 7

FIG. 5.—Oblique fracture of the neck of the right humerus, anterior view. (Case VIII, book 6, page 101.)

FIG. 6.—Oblique fracture of the neck of the right humerus, external view, showing the length and direction of the line of fracture, and the wire in place. (Same as Fig. 5.)

FIG. 7.—Left humerus, anterior view, showing fracture of the surgical neck with the wire in place. (Case IX, book 6, page 121.)

to side entirely through the bone, and heavy silver wire was passed through and twisted on the outer side. The wound was closed without drainage and dressed. There was primary union of the soft parts, and at the end of forty-five days bony union seemed to be good, motion, length, shape, etc., being normal (Fig. 7).

A fracture of the middle third of the shaft was the only one which gave a bad result. This was in a sailor, forty-eight years old, who received the fracture two and one-half years before he came to me. It was operated on soon after it was received, before I saw him, but no union resulted. During the year he was under my observation, two operations were performed. The first consisted in freshening the ends of the bone and fastening them together with iron-wire nails. A small amount of bone formed, but no union took place; so that a second operation was done, this time using a bone ferrule. This remained in nearly five months and then was

removed without having caused any union, although a slight amount of bone had formed. The patient declined further operation and when last seen had a false joint, a skiagram of which is shown in my book.[1]

The supracondylar fractures were treated by incision through the triceps muscle on the back of the arm, or between the brachialis anticus and supinator longus in front, and wiring of the fragments with or without drilling. All gave good results. The T-fractures and condylar fractures were exposed by one of the incisions already given and the fragments fixed by wire or nail. One case is given as an example:

Case II. Book 3, page 9. A boy, seventeen years old, fell and struck on his right elbow, causing a T-fracture of the humerus. Incision was made between the supinator longus, and the biceps and brachialis anticus, being careful not to injure the musculospiral nerve. The lower end of the upper fragment was displaced forward and inward and the condyles were split apart. The fragments were adjusted and the condyles held in place by a steel drill driven through the skin, the external condyle, and deep enough into the internal condyle to hold fast. The external condyle and the lower end of the upper fragment were then wired together after drilling a hole in each (Fig. 8). The drill was removed at the end of seventeen days. Good union followed and almost normal motion—flexion being normal, but extension only 135 degrees. There was considerable formation of callus.

FIG. 8.—Right humerus, anterior view, showing drill through the external condyle into the internal condyle and the external condyle united to the shaft. The dotted line represents the drill. (Case II, book 3, page 9.)

Radius and Ulna. In treating fractures of the radius and the ulna, it is of the first importance to preserve the function of rotation —pronation and supination—by accurately adjusting the fragments. In fractures of the radius just above the insertion of the pronator radii teres, the upper fragment is likely to be rotated outward (supinated) and the lower fragment rotated inward (pronated). In all, 16 operations were done—5 on the radius and ulna together,

[1] Manual of Surgery, p. 253.

1 for Colles' fracture, 1 for fracture of the shaft of the ulna, and 9 for fracture of the olecranon.

In operating on these bones the greatest difficulty is encountered in connection with the radius; the ulna can be exposed, without trouble and without endangering any important structures, by an incision at any point along its posterior border, but the radius is covered by thick muscles in its upper half and by important tendons and the radial nerve in its lower half. Two incisions are necessary when operating on both bones—one for each bone. In fracture of the upper third or of the head of the radius, the incision is best made over the outer and posterior part of the forearm from the external condyle downward over the head of the radius and in the axis of its shaft, dividing the skin and fascia, finding the intermuscular space between the extensor communis digitorum and the extensor carpi ulnaris, and dividing or separating the fibers of the supinator brevis until the bone is sufficiently exposed. The posterior interosseous nerve should be avoided. Branches of the posterior interosseous recurrent artery and other vessels from the anastomosis around the elbow-joint require ligation.

To expose the radius in the middle third, one should make an incision behind the outer border of the forearm along the inner side of the extensor carpi radialis longior, enter the space between the extensor carpi radialis brevior and the extensor communis digitorum until the attachment of the extensor ossis metacarpi pollicis to the radius is exposed. In order to expose the bone sufficiently it may be necessary to separate the attachments of this muscle and those of the pronator radii teres, and, in front, of the flexor longus pollicis. For fractures in the lower third, including Colles', the radius may be exposed by an incision along the outer border of the radius from the styloid process upward, taking care not to injure the radial nerve, which is superficial. The crossing of the carpal extensor tendons by those of the thumb makes it somewhat difficult to expose the radius in the lower third. The best plan is to separate the tendons where it seems easiest and safest in order to expose the fracture. In Colles' fracture, I found it easier to open the "snuffbox"—the space between the extensor longus and the extensor brevis pollicis tendons—exposing the tendons of the extensor carpi radialis longior and brevior, which were retracted to the inner or outer side as might be most convenient.

Olecranon. All fractures of the olecranon do not require operation. Cases are seen in which there is no separation of the fragments, although there is a false point of motion readily detected by making lateral pressure. The fibrous expansion of the triceps tendon, corresponding to the quadriceps expansion about the patella, remains unruptured and holds the upper fragment in place. Separation of a quarter of an inch or more requires operation.

The site of fracture should be exposed by a longitudinal incision

over the olecranon. The elbow-joint is usually opened and is often filled with blood clots, which should be washed away with salt solution. The fragments should be adjusted and can usually be fixed in position by sutures of kangaroo tendon through the fibrous tissue covering the bone. Wire may be used, especially when the soft parts are destroyed to such an extent that sutures will not hold. The wire should not enter the joint, the fragments being drilled obliquely as in the patella, two holes in each fragment; or if preferred, the fragments may be drilled laterally where they are thicker and a single strand of wire used. I have used about equally kangaroo tendon and wire, with good results in all. The limb should be dressed and the forearm carried in a sling at right angles; it is not necessary to put up the forearm in extension.

Femur. Thirteen fractures of the femur were operated on: 4 of the neck, 6 of the shaft, and 3 of the lower extremity, including 2 T-shaped fractures and 1 epiphyseal separation. It may be well to give a brief account of these cases as showing both the good and bad results following treatment:

CASE I.—A man, aged twenty-five years, sustained a fracture of both femurs in the middle third, the left being compound. The left femur (the compound fracture) united in the usual time, but with two inches of shortening, while the right femur refused to unite. It was operated on, a false joint being found. One inch of bone was sawed from each fragment in order to make the femur correspond in length with its fellow; the bones were drilled and fastened with one strand of silver wire. The patient made a good recovery, with legs of equal length, but his stature had been diminished two inches.

CASE II.—A man, aged twenty-five years, sustained a fracture of the right femur in the middle third—upper part. He was operated on the same day through an external incision. The fracture was almost transverse; each fragment was drilled laterally and united by one piece of heavy silver wire. Suppuration followed, but final recovery, with good result, was secured.

CASE III.—A girl, aged eleven years, had an epiphyseal separation of the lower end of the left femur, the result of a wagon-wheel passing over the limb. The usual symptoms presented: great swelling of the knee, floating and prominence of the patella, with an abnormal depression above it, hardness in the popliteal space, and shortening of the femur (Fig. 9). Attempts to reduce the displacement without incision failed, so the parts were exposed by an incision along the outer side of the knee. The patella was found resting on the epiphysis and the epiphysis on the anterior surface of the lower end of the diaphysis. Reduction was accomplished with some difficulty by flexing the leg, making traction on the flexed leg, and by pressure. The wound healed without trouble, after which the patient passed from under my observation.

CASE IV.—A woman, aged sixty-five years, fell, causing a T-shaped fracture of the lower end of the left femur. Attempts to reduce the fragments failed, so that an incision was made along the outer side of the thigh and knee in front of the biceps tendon, exposing the lines of fracture. The fracture was just above the condyles and transverse except for a long spicule which projected from the upper fragment and was embedded in the soft tissues just above the patella. The fractured surface of the condyles presented backward toward the popliteal space. The condyles were split apart, but were held together by the soft tissues. A hole was drilled through the upper fragment and one through each condyle anteroposteriorly; a piece of silver wire was passed through the holes in the condyles and through the hole in the upper fragment, using a piece of wire

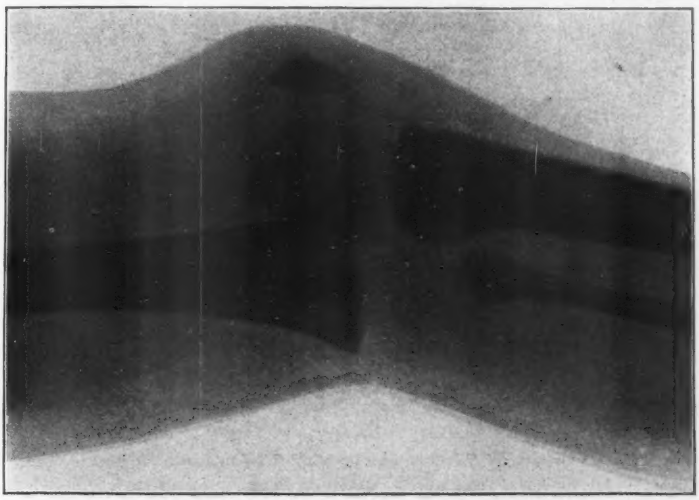

FIG. 9.—Epiphyseal separation of the lower end of the femur.

for each condyle, but both pieces passed through the one hole in the upper fragment (Fig. 10). Plaster-of-Paris was applied with the knee slightly flexed. There was no trouble, and the result was good.

CASE V.—A man, aged twenty-eight years, fell from a platform and suffered a compound T-shaped fracture of the right femur—the lower end of the upper fragment projecting through the skin of the front and inner side of the thigh about two inches above the knee. The incision was enlarged above and below, whereupon the fracture was found to be oblique from above downward and forward. There was also a line of fracture between the condyles, which were movable one on the other, but did not fall apart laterally.

The fragments were accurately adjusted and wrapped with silver wire (Figs. 11 and 12). A good result followed.

CASE VI.—A girl, aged six years, sustained a fracture of the left thigh in the upper part of the middle third; she was treated by vertical suspension; after six weeks there was union with two inches of shortening. Through an external incision a fracture, oblique from above downward and outward, was found. The union was broken up, the parts almost perfectly reduced, and wrapped with silver wire. Healing and union followed, but there was half an inch shortening.

CASE VII.—A woman, aged sixty-three years, had fractured the neck of the left femur seven years before and had been treated for some years for sciatica and other troubles before the diagnosis of fracture was made. Operation was undertaken on account of great and constant pain. An anterior incision exposing the hip-joint was

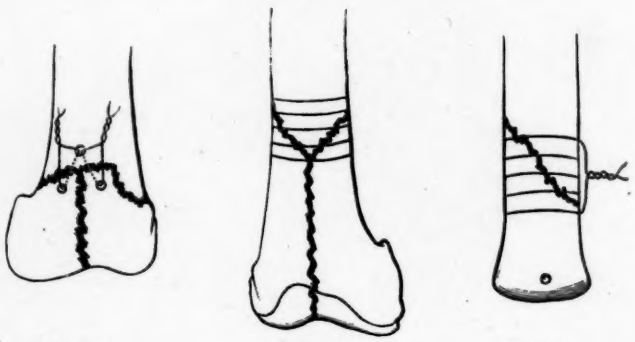

FIG. 10 FIG. 11 FIG. 12

FIG. 10.—Anterior view of T-shaped fracture of the left femur, showing wires in place. The projecting spicula was cut off. (Case IV, book 4, page 12.)

FIG. 11.—Anterior view of T-shaped fracture of the right femur, showing the wire in place. (Case V, book 5, page 94.)

FIG. 12.—Lateral view of the fracture shown in Fig. 11.

made; no union; no callus was found; the head and neck were softened and were removed in fragments. The result was good—complete relief from pain and improved locomotion.

CASE VIII.—A man, aged twenty-four years, sustained a compound fracture of the right femur in the middle third, a fragment projecting through the skin of the outer and posterior surface of the thigh. The wound was enlarged and a second incision to the outer side of the rectus muscle was made. There was considerable laceration of the muscles and three loose fragments of bone were removed. The lower fragment was posterior and external to the upper fragment and separated from it by muscular tissue at least

one inch in thickness. The fracture was transverse. The ends were drilled and wired together end-to-end. The patient had a severe attack of suppurative tonsillitis four weeks after the operation. The wounds in the soft parts healed without trouble and there was considerable callus formed by the end of the second month, but there has been delay in ossification, so that even now, eight months after the operation, there is slight motion at the point of fracture, which very slowly diminishes.[2] The femur is full length.

CASE IX.—A man, aged twenty-one years, fractured his right femur in the upper part of the middle third. An external incision exposed a very oblique fracture over two inches long from above

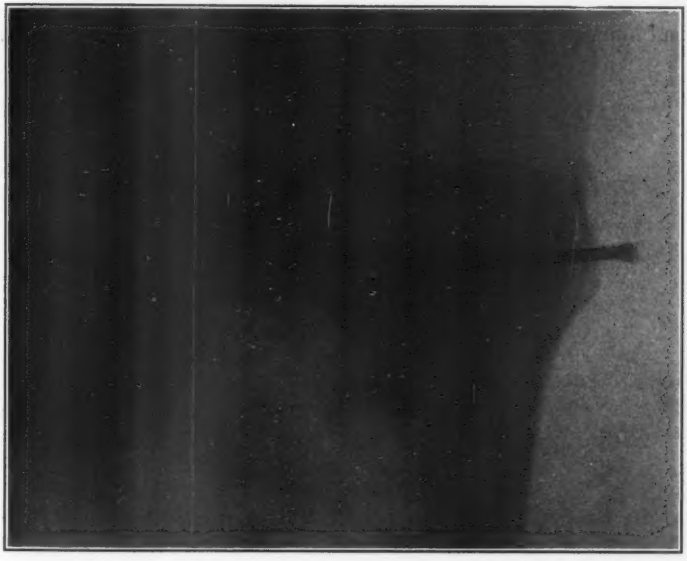

FIG. 13.—Skiagram of a fracture of the base of the neck of the femur, showing the iron nail used to retain the fragments in place.

downward and inward, the lower fragment lying in front and to the outer side of the upper. The fragments were adjusted and wrapped with wire. Union followed without trouble in five weeks, but there was half an inch of shortening, evidently caused by slipping of the fragments. It would have been better to drill the fragments, pass the wire through, and then wrap well with the wire. This would probably have prevented shortening.

CASE X.—A man, aged thirty-one years, fell from a height of ten to twelve feet and struck on the right trochanter major, causing

[2] This patient had fully recovered a month later.

a fracture of the base of the neck. An anterior incision exposed the neck and upper part of the shaft, showing the line of fracture to correspond with the anterior intertrochanteric line, outside the capsule of the joint and leaving the trochanter major attached to and forming the summit of the lower fragment. The lower fragment had slipped up about one inch, but by traction this was brought down. An incision was made through the skin over the trochanter and a three-inch iron-wire nail was driven through the trochanter at its lowest part, into the neck of the femur (Fig. 13). There seemed to be good union at the end of four weeks, but the patient was not permitted to walk until six weeks had elapsed, and was told not to bear any weight on that leg until three months had passed. The result was good; about one-quarter inch shortening; motion and function of the joint are normal. The nail is still in the bone.

FIG. 14.—Anterior view of an intertrochanteric fracture of the left femur, showing the fragments adjusted and two turns of heavy wire in place. (Case XI, book 6, page 104.)

CASE XI.—A woman, aged seventy-five years, suddenly sat down on the floor and fractured the left femur. Under chloroform the upper end of the femur was exposed by an anterior incision. There was fatty degeneration of the muscles and the bone was thinner and more porous than normal. The line of fracture extended from the inner side of the trochanter major downward and inward, a little to the outer side of and diverging from the anterior intertrochanteric line, reaching the inner side of the shaft nearly an inch below the trochanter minor—thus separating the trochanters. The lower fragment lay to the outer side of and behind the upper fragment. The capsule was not opened. No difficulty was met with in adjusting the fragments accurately and in carrying a piece of heavy silver wire twice around the fragments between the trochanters (Fig. 14). The wound was closed without drainage. That night the patient became delirious, the pulse rapid and weak, and death occurred forty hours after the operation. Death was thought to

be due to fat embolism lodging in the brain. Unfortunately, no necropsy was made.

CASE XII.—A boy, aged eleven years, had his left femur fractured in the lower part of the middle third. An incision along the outer border of the rectus muscle exposed the fragments. There was overlapping of two inches, the lower fragment lying to the inner side and posterior to the upper. The line of fracture was nearly transverse. The ends of the fragments were adjusted with considerable difficulty, then two holes were drilled through each fragment—one from before backward, the other from side to side—and two pieces of wire were put in and twisted. The wound was closed without drainage. A good result was obtained in fifty days, with no shortening or deformity (Fig. 15).

CASE XIII.—A man, aged about fifty years, broke the neck of his right femur. An anterior incision showed the line of fracture almost exactly along the anterior intertrochanteric line, the head, neck, and lesser trochanter being separated from the shaft and greater trochanter. The fragments were adjusted and drilled, the

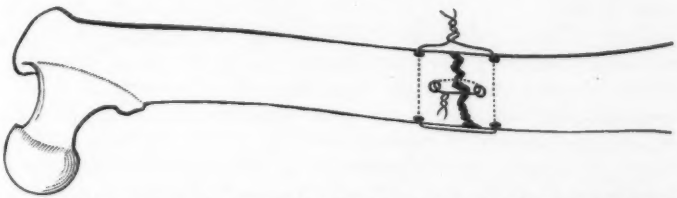

FIG. 15.—Anterior view of a fracture of the middle third of the left femur, showing the fragments adjusted with two strands of wire through holes at right angles to each other. (Case XII, book 6, page 108.)

holes going only to the interior of the bone, and wired. The wound was closed without drainage. Three days later the patient had a general convulsion. Next day the wound was opened and considerable thin fluid or serum with offensive odor escaped. The patient did not improve; his mental condition was confused, the pulse rapid, and death occurred five days after the operation and forty-eight hours after the convulsion—probably from fat embolism in the brain. No necropsy was permitted.

Both these deaths have been attributed to fat embolism, as the symptoms were similar and in general indicative of that condition, although in neither case were there pulmonary symptoms. Case XI might have been attributed to chloroform poisoning, but ether was used in Case XIII. Every surgeon knows that death is not infrequent as a result of fractured femur, probably caused most frequently by fat embolism, and it is quite likely that the ordinary efforts to reduce the fractures in these two patients without operation would have been followed by the same unfortunate result.

For exposing the femur, I prefer the following methods:

Upper Third. Make an incision, four to eight to ten inches long, from half an inch below the anterior superior spinous process of the ilium downward, in line with the outer border of the patella, cutting into the angle formed by the divergence from each other of the sartorius and tensor vaginæ femoris, to the outer side of the rectus, between it and the gluteus medius and minimus. If the fracture is below the trochanters, the vastus externus must be drawn outward and the fibers of the crureus divided and retracted to expose the bone. From three to six branches of the external circumflex artery require ligation. To examine the neck of the femur within the capsule, it is necessary to separate the psoas and iliacus from the capsule and draw them inward with the rectus, and then split the capsule in line with the long axis of the neck.

Middle Third. Make an incision along the middle third in the line which separates the anterior from the external surface of the thigh, find the outer border of the rectus muscle, draw it inward and the vastus externus outward, and divide the fibers of the crureus, which are closely attached to the bone, until it is exposed to a sufficient extent.

Lower Third. Make an incision from the anterior portion of the outer condyle of the femur upward along the outer side of the thigh, exposing and splitting the vastus externus until the bone is exposed. Several arteries from the anastomosis around the knee will require ligation. Care must be taken not to injure the popliteal vessels and nerves or inadvertently to open the synovial cavity of the knee.

Patella. Twenty operations were done for fracture of the patella; the results were all good. One patient only had fibrous union, and this was the result of a Barker operation—a subcutaneous surrounding of the fragments by a silk ligature passing through the joint. The usual operation was a horseshoe incision, wiring the fragments after drilling, union of lateral fibrous expansion with kangaroo tendon, and closure without drainage. The patients were confined to bed for two or three weeks; care in using the knee was insisted upon, motion being limited for three months by means of a bandage or pad.

In addition, there were two ruptures of the quadriceps extensor and one of the patellar tendon; in all three cases the tendon gave way at its attachment to the bone. Kangaroo tendon was used to suture the part in position. The results were good.

Tibia and Fibula. Sixteen tibias were operated on and three fibulas, with good results; but one is still under treatment. Many of these were compound comminuted fractures. Usually, only the tibia was wired when both bones were broken and the ends of the fibula simply adjusted, sometimes wrapped with wire (two cases), but never drilled. To expose the bones an incision is made half an

inch to the outer side of the crest of the tibia. Often both bones can be treated through this incision. Care must be taken not to injure the anterior or the posterior tibial vessels and nerves. If a separate incision is necessary to expose the fibula, this may be made at any point along the line of the fibula from the head to the external malleolus, entering the space between the extensor longus digitorum on the inner side and the peroneal muscles on the outer side, being careful not to injure the musculocutaneous nerve, or, if the operation is near the head of the fibula, the peroneal nerve. Often the position of the incision is determined by a wound already existing in the soft parts. In one case the styloid process and insertion of the biceps were broken from the fibula by muscular action (wrestling). Suture with kangaroo tendon gave a good result.

LEUKEMIC BLOOD PICTURE IN A CASE OF FRACTURE OF THE ANKLE.

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Reports upon the blood findings in cases of fracture are so scarce that it is difficult to form a definite opinion of the frequency with which abnormalities occur. Cabot[1] states that a study of thirty-eight cases, by himself, Hubbard, and Blake, of which fifteen were complicated, showed nothing abnormal. From the figures given, however, it is clear that in a certain percentage of the cases the leukocytes were increased. Ewing and Da Costa give no original observations, and Grawitz also makes no special mention of the findings in fractures. A survey of the journal literature of the past few years likewise brought no data to light. Hastings writes me that in two cases he has seen "myelemia," with myelocytes between 3 and 7 per cent., the one being a severe crush of the thigh (and femur), and the other one of the forearm, with no break in the skin and no evidence of infection.

In view of these meager data the following case report may not be out of place: The patient was a colored man, aged forty-five years, who was admitted, on October 18, 1905, to Dr. Johnson's service at the Maryland General Hospital, with a compound fracture of the right ankle. Careful questioning did not bring out any information which would suggest that the patient had been the subject of myeloid leukemia previous to the accident. He had noticed no lump in the abdomen and had been in his usual strength up to that time.

[1] Pathology of the Blood, 5th ed. p. 400.

Differential counts were made on October 31, November 2, 4, and 6, and showed an increase of the polynuclear neutrophiles (79 to 83 per cent.) and low eosinophile values, but no myelocytes or other unusual condition.

Cellulitis developed, and on November 15 the leg was amputated in the lower third. The day before the amputation the leukocytes were much increased (50,000 estimated) and a differential count revealed a state of affairs which was typical of myeloid leukemia: small lymphocytes, 3.0 per cent.; large mononuclears, 2.5 per cent.; polynuclear neutrophiles, 56.2 per cent.; eosinophiles, 6.2 per cent.; mast cells, 17.5 per cent.; neutrophilic myelocytes, 15.0 per cent.; eosinophilic myelocytes, 1.2 per cent. While counting, 400 leukocytes, 22 normoblasts and several megaloblasts were seen.

These findings, which were first reported by the senior students who had charge of the hematological observations in the case, were verified by my assistant, Dr. Langley, and myself. The spleen, which had not been examined before, was now readily palpable at the costal border.

Unfortunately no blood specimens were taken again until November 21. At that time the leukemic blood picture was much less pronounced. The leukocytes had diminished considerably in number, and myelocytes, while still present, were less numerous. The mast cells had fallen to 4 per cent., and only an occasional normoblast was seen. After that the myelocytes gradually disappeared, and when the patient was discharged the blood picture was entirely normal.

An examination on April 23, 1906, showed 30 per cent. of small lymphocytes, 10 per cent. of large mononuclears, 59 per cent. of polynuclear neutrophiles, 4 per cent. of eosinophiles, and less than 1 per cent. of mast cells. There were no myelocytes and no nucleated red cells.

An examination of the bone-marrow of the amputated foot was unfortunately neglected.

To recapitulate we have a blood picture, occurring in a patient after a compound fracture of the leg, at a time when cellulitis had developed, which bears every mark that is typical of the myeloid type of leukemia. After a week it wanes, and with the recovery of the patient there is a return to normal conditions. The degree of splenic enlargement, when I first saw the patient, a few days after the discovery of the remarkable blood findings, was not at all proportionate to the blood picture, as we generally see it in myeloid leukemia, but not inconsistent with that diagnosis. At the time I was inclined to think that the case was a true leukemia and that the accident had possibly occurred during a "normal" interval. But the subsequent course of the myelemia inclined me to abandon this view. The return of the mast cells to the normal especially

speaks against this possibility. Ehrlich long ago pointed out that the increase of the mast cells is the most constant and characteristic symptom of myeloid leukemia, and I have pointed out at another place that this increase will persist even though the spleen may return to normal size and the blood picture clear up otherwise. Nevertheless, we must assume a *vis a tergo*, and notwithstanding the well-known effect of septic infection upon the character of the leukocytosis under ordinary circumstances, I believe that this factor must be viewed directly or indirectly as a causal element after all. It is known that in osteomyelitis, myelocytes may appear in the circulating blood in large numbers, although this does not occur in every case. An increase of the mast cells and the simultaneous occurrence of nucleated red cells, on the other hand, have not been observed. I can imagine, however, that the findings may differ with a varying localization of the inflammatory process, and that extensive involvement of red marrow may give rise to a different picture than would result if the fatty marrow were largely affected. This idea would, in a manner, presuppose the origin of the marrow elements from the affected structures, which would, on the face of it, seem unlikely. On the other hand, one might imagine that the extensive destruction of red marrow in the injured bones, especially after development of the infection, might lead to a stimulation of the red bone-marrow at large and a resultant functional hyperactivity and the mechanical discharge of bone-marrow elements into the circulation. In this sense the temporary myelemia in my case could be regarded as the leukocytic counterpart to the "crises" affecting the red cells, which are occasionally observed in certain types of severe anemia. This view is the one to which I incline. The case is certainly unique and is reported with the idea of bringing out records of similar cases, which have not yet been reported in the literature.

THE LUYS URINE SEPARATOR.

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The history of separators for the intravesical separation of the urine from the two kidneys dates from 1890, when Lambotte,[1] of Brussels, first introduced an instrument which proved unsuccessful. In 1897 Neumann[2] was also unsuccessful in producing a separator

[1] Etude sur la taille du rein. Jour. de méd. de chir. et de phar., Bruxelles, Septembre, Octobre, et Novembre, 1890.

[2] Ein einfache Methode den Urine beider Nieren bei Weibe gesondert aufzufangen. Deutsch. med. Woch., October 21, 1897.

for use in the female. Harris,[3] of Chicago, next introduced his segregator, which was untrustworthy, and caused much pain to the patient. In 1901 Luys,[4] of Paris, introduced his separator. The large caliber of the early instrument limited its use to the female. Later the caliber was made smaller, so that it could be employed in the male and the female. In 1902 Cathelin,[5] of Paris, introduced still another segregator, but this seems to be more complicated than the Luys, and causes more pain.

The largest number of cases published is 210—by Luys himself.[6] In none of these cases was the cystoscopic examination methodically used. In addition to these, important work has been done by Zuckerkandl, of Vienna, and his assistant, Lichtenstern;[7] the late Mikulicz,[8] of Breslau; Israel,[9] of Berlin; Emile Burckhardt,[10] of Bâle, and Bickerstith,[11] of Liverpool. There are a number of other articles, mainly by French, German, and English writers, but none that I can find from America.

Next to Luys, Lichtenstern (Zuckerkandl's assistant) quotes the largest number of cases, twenty-three in all, in which the separator was employed. This series is of especial interest to me, since it was in Zuckerkandl's clinic that I first saw the separator used, and learned the technique of its use.

In 14 of these 23 cases the findings of the separator were confirmed by operation, either before or after the urinary separation. In the remaining 9 cases the findings so corresponded with the symptoms and physical signs as to admit of no reasonable doubt of their accuracy. Lichtenstern says: "The separation is so exact that not only may the possibility of organic admixture be completely eliminated, but also chemically we may find a marked difference on both sides, as, for example, in pyonephrosis we often observe a difference in the reaction of the urine of the two sides."

Bickerstith quotes 9 cases, in all of which the separator findings were confirmed by operation. Luter, assistant to Burkhardt, quotes 7 cases, in 4 of which the results were confirmed by operation or autopsy.

Caspar,[12] of Berlin, says: "Segregators can occasionally be used with benefit, and in default of the possibility of ureteral catheterization

[3] The Use of the Urine Segregator in the Diseases of the Urinary Tract, N. Y. Med. Rec., April, 1898.

[4] La séparation de l'urine des deux reines, Assoc. Fran. d'Uro., Paris, Octobre, 1901.

[5] Le diviseur vesical gradué à sondes metalliques lateralis mobils, Assoc. Fran. d'Uro., Paris, Octobre, 1902.

[6] La séparation de l'urine des deux reines, Paris, 1904.

[7] Erfahrungen über Harnsegregation. Wiener klin. Woch., 1904, No. 29.

[8] Manuscript letter to Dr. Luys from Gottstein, assistant to the Surgical Clinic, Breslau.

[9] Manuscript letter to Dr. Luys from Dr. Frank, of Berlin, in the service of Prof. Israel, Berlin.

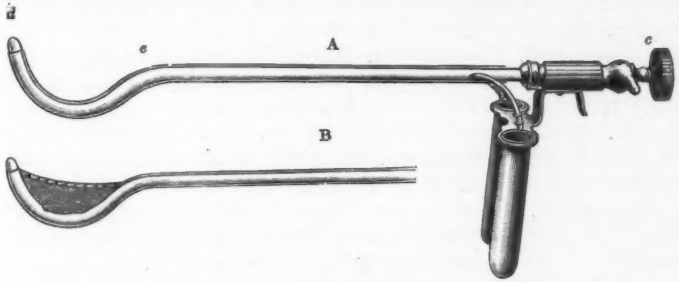
[10] Ueber den Harnscheider von Luys. In Correspondenz-Blatt f. Schweizer Aerzte, 1904, No. 18.

[11] Intravesical Separation of the Urines, Lancet, March 28, 1904, and Intravesical Separation of the Urines, Brit. Med. Jour., October, 1904.

[12] Handbuch der Cystoskopie, Leipzig, 1905.

are to be used and recommended. But they are not as exact for all cases as catheterization is, and on this account are inferior. The sovereign means of diagnosis remains with ureteral catheterization; only when this is not practicable may a segregator, either Luys or Cathelin's, be tried." Kummell,[13] of Hamburg, says, "No separator or segregator can give absolutely accurate results." Von Frisch,[14] of Vienna, Posner,[15] and others have given like opinions.

THE INSTRUMENT. The Luys instrument (see figure) when ready for introduction into the bladder (A) has the form of a Béniqué metal sound and corresponds to 21, French scale. The portion from *d* to *e* (A) is the intravesical part. The entire instrument may be separated into three portions, one central and two external. A long slender glove-finger of rubber is fitted over the central portion, which in its intravesical part contains a fine chain. By a mechanism at *c* (A) the chain may be tightened and the rubber covering it put on a stretch, so forming a diaphragm



which, when the instrument is in position, divides the bladder into halves (B). The lower portion of the rubber diaphragm comes in contact with the bladder wall at *f* (B). The two external portions of the separator are tubes through which the separated urine flows. These tubes have each three fenestrations on the side toward the rubber diaphragm for the entrance of the urine from the ureters.

When the separator has been introduced and the diaphragm adjusted, the empty bladder by virtue of its muscular action grasps the separator, the right ureter emptying its urine on one side close to the diaphragm, and the left on the other side.

TECHNIQUE OF SEPARATION. The instrument must be examined before and after using.

Before Using. (1) To see that both tubes of the separator are permeable; that their lumen is not at all narrowed by dirt, rust, etc.

[13] Münch. med. Woch., October 17, 1905, p. 2057. Report from Kongress der Internationalen Gesellschaft f. Chirurgie."

[14] Handbuch der Urologie. A. v. Frisch und O. Zuckerkandl, Band I, p. 651.

[15] Kann der Harnleiterkatheterismus durch Harnsegregatoren ersetst werden. Berl. klin. Woch., 1903, No. 16.

(2) The membrane should be examined for perforations. (3) The instrument should be sterilized by boiling.

After Using: (1) The membrane should again be examined for perforations. (2) The intravesical portion of the separator should be examined for blood clots. Perforations of the membrane would, of course, negative results. Blood clots on the diaphragm would, as I shall attempt to demonstrate later, modify results.

The Bladder. (1) The bladder capacity should at least be 20 c.c. This limit is given by Lichtenstern. The minimal bladder capacity with which I have used the separator is 50 c.c. When the bladder capacity is much less than this it would seem better to use the smaller Luys instrument, made for children. (2) The urethra should be penetrable to the instrument. (3) Conditions which distort the base or neck of the bladder may prevent separation. The main among these are: (*a*) Marked prostatic hypertrophy; (*b*) extreme anteversion or anteflexion of the uterus; (*c*) various uterine tumors, as advanced carcinoma of the cervix involving the anterior vaginal wall; and (*d*) marked cystocele. (4) The bladder should be cystoscoped. "A classical example for the necessity of this exploration is the perforation of a para- or perimetritic abscess into the bladder, in which with normal kidneys separation alone may lead to the diagnosis of one-sided pyuria. (5) The bladder should be washed with sterile boric-acid solution until the returning fluid is entirely clear, and then 40 to 50 c.c. allowed to remain in the bladder.

Introduction. The separator having been sterilized and lubricated with sterile glycerin, and the bladder prepared under aseptic precautions, the patient is ready for its introduction. The patient should be in the dorsal position, with the trunk horizontal upon the table, the pelvis at the edge of the table, and the feet upon supports below the table level.

With women the introduction is very simple and as a rule painless. The tip of the separator is inserted into the urethra as a sound or catheter, and the instrument following the curve of the urethra glides into the bladder. Vaginal palpation may be employed to verify its position, but I have seldom found this necessary.

With men the introduction is more difficult and more painful. The instrument is introduced into the male urethra in the same manner as a Béniqué sound until the tip is at the prostatic urethra. Then slowly and with much care the handle of the instrument is depressed, there being at the same time a constant and steady pressure along the axis of the separator. With or without a slight jump the separator enters the bladder, whereupon the handle should be elevated. The separator being within the bladder the patient should be elevated to a sitting position, with his back supported at an angle of about 60 degrees to the table.

The diaphragm should be adjusted and the handle of the separator gently raised until the intravesical portion meets resistance

along the lower bladder wall. When the separation has been completed the diaphragm should be lowered and the instrument removed, reversing the steps of introduction.

With the separator in position the adjusting of the diaphragm causes little or no pain. If the separator is not entirely within the bladder, the elevation of the diaphragm causes trauma of the vesical sphincter. When this is the case much pain is usually caused by screwing up the diaphragm, and bleeding occurs and will become manifest in the urine that flows from the tubes of the separator.

Before the instrument is entirely within the bladder, fluid begins to run irregularly from the tubes.

It has been my custom to stop the flow of boric solution from the tubes until the separator is wholly within the bladder, the diaphragm adjusted, and the patient elevated to the sitting position; these manipulations being less likely to cause trauma to the mucous membrane if fluid be within the bladder.

When the boric solution has run out the separated urine begins to flow. Lichtenstern says: "A safe index for the proper position of the instrument is given by the manner of the urinary flow from the tubes. Normally, in rhythmical intervals, series of drops are excreted corresponding with the contraction of the ureter and the alternating function of the kidneys. If the instrument is not properly placed the urine can either flow in continuous drops, or the tubes excrete nothing, and between them and the separating rubber membrane the urine trickles out."

Slight hemorrhage occurs, in some cases resulting from the bladder muscle grasping the instrument too vigorously and causing trauma of the bladder mucous membrane. This rarely occurs in normal bladders, not infrequently in diseased, and is manifested (1) by small blood clots along the rubber membrane, seen when the instrument is withdrawn; and (2) by a slight and equal increase of the fresh red blood cells in both of the separated specimens.

The exactness and constancy of this second condition has been proved by comparing, in the same case, the separator results with the results of ureteral catheterization. Thus, if we find slight blood clots along the membrane of the withdrawn instrument, we may expect a slight increase of the fresh red blood cells of both sides and must not mistake their origin and make a diagnosis of renal hematuria. I have never found, in these cases of traumatic hemorrhage, that catheterization of the ureters gave more exact results.

Summary of Cases. The instrument has been used in 14 cases, 2 male and 12 female. In 2 of the 14 cases (Cases I and II) there was absence of the kidney on one side. In a third (Case III) partial nephrectomy had been done. In the remaining 11 cases there were 2 (Cases IV and V) of unilateral pyonephrosis; 2 of pyelitis, bilateral (Cases VI and VII); 1 of pyelonephritis, bilateral (Case VIII); 1 case of unilateral nephritis (Case IX); 1 of tuberculous kidney,

unilateral (Case X); 3 cases of unilateral hematuria (Cases XI, XII, and XIII), and 1 case of bilateral hematuria (Case XIV).

Five of the 14 cases have been catheterized (Cases III, VIII, X, XI, and XIV). The results in 3 of the 5 catheterized cases (Cases III, VIII, and XI) agree with the separator results. In 1 of the 5 the separator gave probably more exact results than catheterization (Case X), and in the last of the 5 catheterization apparently gave more accurate results than the separator (Case XIV), but the subsequent history leaves this in doubt. 7 of the 14 (Cases I, II, III, IV, V, VIII, and XIV) have been operated upon either before or after separation. In 6 of these cases the results of separation were confirmed by operation. The seventh is Case XIV, referred to above. All of the cases have been cystoscoped. In none of the cases was the separator proved to be inaccurate. In the cases in which operation was not done nor ureteral catheterization performed, the separator results agreed with the symptoms, physical signs, and cystoscopic findings. In 2 of the 14 cases there was a marked difference in the reaction of the urines of the two sides (Cases IV and V). In 9 of the 14 cases there were pathological conditions of the bladder: 4 with chronic cystitis with ulcerations or erosions; 2 with simple chronic cystitis; 1 of tuberculous bladder; 1 of trabecular hypertrophy; 1 simple congestion.

The following are notes of several of the more interesting cases:

CASE I.—Edna G., aged twenty-four years. One and one-half years ago nephrectomy was done, in Bellevue Hospital, for left-sided tuberculous kidney. A sinus in the left lumbar region still persists.

Cystoscopic. Bladder capacity 175 c.c. Bladder wall and ureteral openings normal.

Separation. The separator was easily introduced and remained in place thirty minutes. In that time not a drop of urine came from the left tube of the separator. From the right tube 30 c.c. of clear urine flowed in fifteen minutes.

Analysis. Right urine: Clear, light yellow; acid; albumin, slight trace; Δ (freezing point) —0.64; sugar, negative. Precipitate (by centrifuge) slight, showing few red blood cells and few leukocytes.

CASE II.—Mrs. Rose T., aged thirty-four years. Admitted to New York Hospital, service of Dr. F. W. Murray, March 21, 1906. For the past year patient has had pain more or less continuous in right lumbar region. The urine has been intermittently cloudy and bloody. Loss of flesh and strength. For the past two months, pain and prostration have been much worse. Fever and chills. Urination very frequent. Right kidney was much enlarged and tender. At operation a right-sided pyonephrotic sac was found, incised, and drained. Two months later the patient was cystoscoped and the separator used.

Cystoscopic. Bladder capacity 200 c.c. Moderate degree of trabeculous hypertrophy present. Left ureteral opening normal, urine coming forth. At the position of the right ureteral orifice there is a mass of reddened granulation tissue. No opening seen.

Separation. The separator was easily introduced and remained in place thirty minutes. In that time two or three drops of whitish fluid were excreted from the right tube. The time of excretion of these few drops corresponded with the periodic vigorous contractions of the irritable bladder upon the separator, and were evidently drops of boric-acid solution remaining in the bladder. From the left tube 17 c.c. of urine was collected.

Analysis. Left urine: Slightly cloudy, amber; acid; albumin, moderate trace; sugar, negative; precipitate (by centrifuge) moderate, showing a moderate number of fresh red blood cells, few leukocytes, and a few squamous epithelial cells.

This case is interesting in that the separator gave exact results in a bladder with trabecular hypertrophy.

CASE III.—Mrs. Mary L., aged twenty-nine years. Case of Dr. T. B. Barringer, Jr. Six years ago, following a bullet wound, a left-sided nephrectomy (according to patient) was done at the Harlem Hospital. The cicatrix of the old wound is present in the left lumbar region.

Cystoscopic. Bladder capacity 200 c.c. Bladder and ureteral openings are normal. Both ureteral mouths contracted regularly, the contractions of the left side being at longer intervals than those of the right.

Separation. Separator easily introduced. From the right tube urine began to flow rhythmically, 20.5 c.c. collecting in forty-five minutes. From the left tube no urine appeared up to ten minutes; then, quite irregularly, urine began to flow from the left side, 7.25 c.c. collecting in forty-five minutes.

Analysis. Right urine: Clear, yellow; acid; albumin and sugar negative. Precipitate (by centrifuge) slight, showing few cylindroids.

Left urine: Cloudy, yellow; acid; albumin and sugar negative. Precipitate (by centrifuge) slight, showing rare leukocyte; rare pyriform cell.

2 c.c. of a 4 per cent. solution of indigo-carmine was injected into the gluteal region. In twenty-five minutes the right urine was decidedly blue. On the left side there was no trace of blue up to thirty-five minutes.

At a later date the separator was again used: from the right side 99 c.c. of urine collected in seventy minutes. For thirty-five minutes no urine flowed from the left tube: from then up to seventy minutes 3.75 c.c. of urine was collected. The patient's ureters were now catheterized. The right ureter was easily catheterized; the left ureter admitted only a small catheter. In fifteen minutes 65 c.c. of normal

urine was collected from the right. Up to thirty minutes none was secreted from the left.

In this case while the separator results do not entirely correspond with catheterization, there are two reasons for believing that the former was exact: (1) Cystoscopically, the left ureteral mouth was seen to contract more or less rhythmically; this would not be if it had not excreted urine for six years. (2) After the indigo-carmine injection for ten minutes there flowed a fairly intense blue from the right tube of the separator and absolutely no trace of color from the left side. This would be impossible if fluid from the left side was the result of leakage from the right.

CASE IV.—Mrs. Sarah M., aged thirty-five years. Case of Dr. E. D. Barringer.[16] For past year pain in right lumbar region, cloudy urine, frequent urination, progressive loss of flesh and strength. The right kidney was enlarged and tender.

Cystoscopic. Bladder capacity, 100 c.c. Urine very cloudy. Right ureteral orifice swollen, ulcerated. While being observed a thick, dense, yellow stream of pus was excreted from ureteral orifice. Left ureteral orifice, mucous membrane slightly swollen; clear urine excreted.

Separation. The separator was easily introduced. In eight minutes 5 c.c. of thick yellow pus flowed irregularly from the right tube, and 49 c.c. of clear urine from the left.

Analysis. Right urine: Opaque, yellow; strongly acid; albumin, heavy trace; sugar, negative. Half of the fluid is precipitate composed almost entirely of pus cells; rare red blood cell.

Left urine: Clear, yellow, slightly acid; albumin, negative; sugar, negative. Precipitate (by centrifuge) slight, composed of occasional red blood cells, leukocytes (no pus), and epithelial cells.

Diagnosis. Right pyonephrosis. The patient was operated upon at Mount Sinai Hospital where a right pyonephrosis with multiple stones was found.

The difference in reaction of the urine from the two kidneys is of interest.

CASE V.—Mrs. Ada M., aged thirty-three years. Admitted to New York Hospital, February 16, 1906, in the service of Dr. F. W. Murray. The patient was operated upon by Dr. Murray, who found in the left kidney a number of large abscess cavities with multiple stones. The stones were removed and the kidney drained. Some weeks later the patient was cystoscoped and the urine separated.

Cystoscopic. Bladder capacity, 100 c.c. Urine turbid with pus. Pus was being excreted into bladder so rapidly as to make the cystoscopic examination difficult, and it would have been hard if not impossible to catheterize the ureters. Pus was seen, thick and

[16] This case was separated and cystoscoped by Dr. E. D. Barringer.

yellow, coming from the left ureter. The right ureteral mouth was imperfectly seen: chronic cystitis of base of bladder.

Separation. The separator was introduced with considerable pain, without rewashing the bladder. Thick yellow pus began to flow, drop by drop, from the left tube: 3 c.c. in fifteen minutes. Slightly cloudy urine flowed rhythmically from the right: 10 c.c. in fifteen minutes.

Analysis. Right urine: Slightly turbid, amber; acid; albumin, trace; sugar, negative; urea, 0.003 gram to c.c. Precipitate (by centrifuge) moderate; composed of few red blood cells, many pus cells, and a moderate number of round and squamous epithelium.

Left urine: Opaque, yellowish white; alkaline reaction; albumin, marked trace; sugar, negative. One-half of the fluid was precipitate, composed almost entirely of pus cells, few round epithelial cells.

Diagnosis. Left, pyonephrosis; right, pyelitis. Three days later the separator was again used, the bladder being washed entirely clean. The bladder urine showed much less pus and a much larger discharge came from the nephrotomy incision.

In twenty-five minutes but 1 c.c. of turbid fluid flowed from the left tube. From the right, 20 c.c. of nearly clear urine flowed. The analysis of these urines was the same as above, the only difference being in the quantity of pus excreted from the left side. 1 c.c. of a 1 per cent. phloridzin solution was injected into the buttock; sugar appeared in the right urine in from thirty to thirty-five minutes, and none in the left urine. At a second operation the left kidney was found practically composed of abscess cavities.

Case VI.—Mrs. Fannie M., aged thirty years. Admitted to New York Hospital, in the service of Dr. Bolton, September 11, 1905. Patient's history suggests attacks of intermittent hydronephrosis. While in the hospital she had several chills and fever. Bilateral nephroptosis, much more marked on right, was present.

Cystoscopic. Bladder capacity 175 c.c. Entire bladder with ureteral openings congested. Urine coming from both ureteral orifices.

Separation. Separator easily introduced, urine flowing rhythmically from both tubes, 12 c.c. in thirty minutes, from right; 11 c.c. in thirty minutes, from left.

Analysis. Right urine: Clear, yellow; reaction, acid; albumin, marked trace; sugar, negative; Δ —0.91. Precipitate (by centrifuge) slight, showing few red blood cells; many leukocytes; pus; few pyriform epithelium; few cylindroids.

Left urine: Clear, yellow; reaction, acid; albumin, marked trace; sugar, negative; Δ —1.62. Microscopically, the same as right.

3.5 c.c. of a 4 per cent. solution of indigo-carmine was injected into the gluteal region with the following results: in twenty-three minutes marked blue from left side; right urine, no trace of blue;

in thirty minutes, distinct blue on right side, never as marked as on the left.

Diagnosis. Bilateral pyelitis. Decreased functional activity of the right kidney as compared with left. This latter finding corresponded with the history, that of intermittent hydronephrosis, and with the physical examination.

CASE VII.—Mrs. D. M., aged twenty-nine years. Case of Dr. T. B. Barringer, Jr. Some weeks before being seen the patient developed bilateral pyelitis, following cystitis. She then developed symptoms pointing toward obstruction of the left ureter. She was seen with a view to ascertaining if the left ureter was plugged, and if so, to attempt to catheterize it to drain off the pus. Both kidneys were markedly tender, and the right kidney decidedly enlarged.

Cystoscopic. Bladder capacity, 200 c.c. The base of the bladder showed a marked cystitis with eroded areas. Ureteral openings could not be seen.

Separation. Separator introduced without pain. Slightly cloudy urine flowed rhythmically from both tubes: 6.5 c.c. in ten minutes from right; 6.5 c.c. in ten minutes from the left.

Analysis. Right urine: Slightly cloudy, yellow, acid; albumin, heavy trace; sugar, negative; Δ —1.09.

The moderate precipitate (by centrifuge) was composed almost entirely of cells of the renal collecting tubules and pelvis of the kidney with occasional leukocytes and red blood cells.

Left urine: The analysis and microscopic examination corresponded with the right, Δ being —0.91.

Diagnosis. Bilateral pyelitis. In this case, because the ureteral openings could not be seen, the only way to diagnose positively the permeability or impermeability of the left ureter, without the use of the separator, was to await the development of symptoms.

CASE IX.—Dora T. H., aged fifteen years. Patient in Dr. A. B. Johnson's service, New York Hospital. Patient gave a history pointing to disease of the left kidney.

Status Localis. Tenderness and rigidity in right lumbar region. The analysis of a non-catheterized specimen of bladder contents was as follows: A turbid, amber, acid urine; moderate flocculent precipitate; specific gravity, 1026; albumin, very faint trace; sugar, negative. Much pus; hyaline, granular and leukocytic casts; few epithelial cells. The presence of hyaline and granular casts in the patient's urine was constant.

Cystoscopic. Bladder and ureteral openings normal.

Separation. Urine flowed rhythmically from both tubes, 9 c.c. in twenty minutes from right, and 10 c.c. in twenty minutes from left.

Analysis. Right urine: Clear, yellow, acid; albumin, trace; sugar, negative; Δ —0.94. Very slight precipitate composed of rare leukocyte, frequent hyaline and granular casts.

Left urine: Clear, yellow, acid; albumin, negative; sugar, negative; Δ —1.34. Microscopic, negative.

On a later separation both urines were normal. Later a profuse vaginal discharge made its appearance. An exploratory laparotomy showed large right-sided pyosalpinx.

Diagnosis. Because of the constant appearance of albumin and casts in the bladder urine, and because in two separated specimens the left urine was normal, a diagnosis of right-sided nephritis was made, caused possibly by the right pyosalpinx.

CASE X.—Hazel T., aged fourteen years. Admitted to service of Dr. F. W. Murray, New York Hospital, April 18, 1906.

History covering eighteen months of increased frequency of urination and cloudy urine. Deep pressure gives tenderness over the right kidney. Ureteral catheterization was performed: 15 c.c. flowing from the right side in ten minutes, and 15 c.c. from the left in ten minutes.

Analysis. Right urine: Turbid, yellow, acid; albumin, trace; sugar, negative. Urea 0.002 gram to c.c. Moderate precipitate (by centrifuge), showing many red blood cells; many pus cells; moderate number of renal and ureteral cells; one hyaline cast; many tubercle bacilli.

Left urine: Turbid, yellow, acid; albumin, trace; sugar, negative. Urea, 0.002 gram to c.c. Microscopic, was the same as the right, with the exception that no tubercle bacilli were found. The only difference in the two sides is the finding of tubercle bacilli in the right in considerable numbers, and the failure to find them in the left. A few days later the patient was cystoscoped and urine separated.

Cystoscopic. Bladder capacity, 50 c.c. Right ureteral orifice enlarged, reddened, and thickened. Mucous membrane swollen around ureteral mouth and ulcerated in places. Left ureteral mouth normal.

Separation. The separator was introduced with considerable pain. In twelve minutes 4 c.c. of turbid urine flowed from right side, irregularly, and 20 c.c. of clear urine flowed rhythmically from the left.

Analysis. Right urine: Cloudy, yellow. (Albumin, etc., not taken.) Marked precipitate (by centrifuge) composed of many blood shadows; some fresh red blood cells; many pus cells; much renal epithelium; occasional hyaline and granular casts; many tubercle bacilli.

Left urine: Clear, yellow. (Albumin, etc., not taken.) Slight precipitate (by centrifuge) composed of very many fresh red blood cells; occasional leukocyte, no pus; occasional renal and vesical epithelium; one epithelial, two hyaline casts; no tubercle bacilli.

This was a case in which catheterization of both ureters was very difficult and the separator apparently gave more accurate results. The left ureteral orifice was by cystoscopic examination entirely

normal. The main abnormal finding of the separated left urine was "many fresh red blood cells." But these were the precipitate of 20 c.c. of fluid, while there was but 4 c.c. of right urine to give the precipitate for microscopic examination. So, relatively, there must have been but few red blood cells in the left urine, and these were traumatic, the bladder being small, irritable, and tuberculous. No pus was found in the left urine. A few hyaline and epithelial casts were present, and there was a marked difference in the amount of urine secreted: 4 c.c. from the right as compared with 20 c.c. from the left, in twelve minutes.

Diagnosis. Right tuberculous kidney, normal left kidney. The patient is expected to come to operation.

CASE XIV.—James J. M., aged twenty-four years. For past ten years he has had attacks of pain in left kidney region, sharp and stabbing, running into left testicle. Over the left kidney and along the course of the left ureter there is rigidity and tenderness.

Cystoscopic. Bladder normal; left ureteral orifice slightly congested.

Separation. Separator introduced, with some pain—none when in position. Urine flowed rhythmically from right side, 9 c.c. in thirty minutes; irregularly from left, 12 c.c. in thirty minutes.

Analysis. Right urine: Clear, amber, acid; albumin, heavy trace; sugar, negative. Moderate precipitate (by centrifuge) composed of many red blood cells; many leukocytes, pus; many squamous; few pyriform cells.

Left urine: Exactly the same as the right.

From the separation, it was thought, notwithstanding that all the symptoms pointed toward the left kidney as the main seat of the trouble, that the right kidney was also affected.

The patient was admitted to the New York Hospital, where the ureters were catheterized, with the following results:

Analysis. Right urine: Clear, amber, acid; albumin, faintest possible trace; sugar, negative. Slight precipitate (by centrifuge) composed of occasional red blood cell, occasional leukocyte; numerous spheroid, and caudate epithelium.

Left urine: Clear, light amber, acid; albumin, faint trace; sugar, negative. Moderate precipitate (by centrifuge) composed of many red blood cells; many pus cells; occasional renal cell; no tubercle bacilli.

The patient was operated upon by Dr. Markoe, who removed a stone from the left kidney pelvis. The catheterized specimen apparently gave more accurate results than the separated. Both gave abnormal findings for the right kidney, but the separator much more positively so. The separation took place just after the patient had walked to my office; the catheterization, after he had been in bed two days. When seen about three months after leaving the hospital he gave a history of symptoms of the right kidney, pain,

etc., exactly similar to those he had on the left side. Since then the patient has not been seen.

CONCLUSIONS. 1. There is a large class of cases in which knowledge of the condition of the kidneys is necessary and in which the ureters cannot be catheterized. These are cases in which (*a*) one or both ureteral openings are obscured by cystitis; (*b*) in which the rapid excretion of pus or blood into the bladder clouds the bladder fluid; or (*c*) in which in a normal bladder one or both ureteral mouths cannot be found. These are cases in which the separator is invaluable.

2. Cystitis forms no barrier to the use of the separator and to obtaining an exact knowledge of the kidney conditions in such cases. The exception to this is when a bacteriological examination is necessary, when catheterization of the ureters is more accurate.

3. Separation is much simpler than ureteral catheterization. The sterilization of the instrument is absolute, as the separator can be boiled. Infection of the ureters from the bladder is excluded.

4. In women the pain or discomfort caused by the separator is about the same as that caused by the use of a simple examining cystoscope. In men the pain of separation is slightly more marked.

5. There are certain classes of cases in which the separator cannot be used. They are the following: (A) Those in which the bladder capacity is less than 20 c.c.; (B) those in which the urethra is not penetrable to the instrument; and (C) those in which the base or neck of the bladder is distorted by (*a*) marked prostatic hypertrophy; (*b*) extreme anteversion or anteflexion of the uterus; (*c*) certain uterine tumors; and (*d*) marked cystocele.

6. Slight hemorrhage occurs in some cases resulting from the bladder muscle grasping the instrument too vigorously and causing trauma of the vesical mucous membrane. This is shown by (*a*) small blood-clots along the membrane when the separator is withdrawn; and (*b*) slight and equal increase in the fresh red blood cells of both sides.

7. Any inaccuracy of results obtained by the use of the separator is to be attributed to its employment in unsuitable cases or to a failure to recognize traumatic hemorrhage when it occurs; and does not arise from leakage of the urine from one side to the other.

I wish to express my thanks to Dr. Samuel Alexander for many valuable suggestions; to Drs. F. W. Murray, P. R. Bolton, A. B. Johnson, and F. H. Markoe for the use of cases in their respective services at the New York Hospital; to Drs. T. B. Barringer, Jr., C. E. S. Webster, Jr., and E. D. Barringer for referred cases; and to Drs. J. C. Roper, T. W. Hastings, and Mortimer Warren for many urine analyses.

THE COLLOIDAL NITROGEN IN THE URINE.

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In the course of an investigation[1] which one of us has been making into the clinical significance of the complete analysis of the urine with respect to the nitrogenous constituents, our attention has been called to a paper by E. Salkowski[2] on a fraction of the nitrogen which is precipitated by absolute alcohol. This fraction he terms colloidal nitrogen.

It would appear from Salkowski's paper that in speaking of colloidal nitrogen, he had in mind the large number of substances which are comprised under the head of undetermined nitrogen, that nitrogen which is left unestimated after the more prominent constituents of the urine, the urea, ammonia, uric acid, creatinin, and creatin are estimated. The nature of these substances is not well understood, but among them are the sulphur-containing acids, the proteic acids which have been recently made the subject of renewed investigation by Bondzynski[3] and his co-workers.

From a clinical point of view, one thing seems probable: The undetermined fraction is increased both absolutely and relatively to the undetermined nitrogen in many metabolic disturbances of pathological origin.

As the methods for estimating the undetermined nitrogen are outside the range of clinical technique, and the method for estimating the colloidal nitrogen could be performed by the clinician without a great deal of difficulty, it appeared desirable to correlate the two methods in order to ascertain whether they bear a relation to one another. Furthermore, the results obtained by Salkowski in the analyses of normal and pathological urine bore a striking similarity to some of our own which were made with the more exact methods of urine analysis.

At the outset, it must be confessed, it did not seem probable that the two methods would agree, for part of the substances precipitated by alcohol are present in the determined nitrogen, while some of the compounds not precipitated by alcohol are members of the class of undetermined nitrogen. In the former class would be included

[1] Ewing and Wolf. Amer. Jour. Med. Sci., 1906, cxxxi, 751.

[2] Berl. klin. Woch., 1905, xlii, 1581, 1618.

[3] Bondzynski, Dombrowski, and Panek. Ztschr. f. physiol. Chem., 1905, xlvi, 83.

creatin and creatinin and the urates, while in the latter would be included the alcohol-soluble amino-acids, glycocoll and leucin.

As glycocoll has recently been made the subject of a number of investigations[4] which tend to show that either the acid itself or a compound in which the acid is an integral part is a constituent of normal urine in conspicuous amount, and as this finding in its clinical relation is at present the subject of an interesting discussion, our interest in the matter of colloidal nitrogen was increased. If it could be shown that the amount of glycocoll is an important feature in the analysis of the urine, we should expect to find that the colloidal and undetermined nitrogens from this cause alone would not be in close agreement.

The methods used in the determination of the urea, ammonia, uric acid, creatinin, creatin have been detailed by one of us in a recent paper.[5] The estimation of colloidal nitrogen is a simple procedure, and when properly carried out yields closely agreeing duplicate analyses. One hundred c.c. of urine is evaporated slowly to a syrup. To the residue 100 c.c. of absolute alcohol is added, and the mixture allowed to stand for a few minutes. The concentration of the urine should be regulated carefully. If the urine is too concentrated, the addition of alcohol precipitates a gummy mass, which cannot be washed free from urea. If the urine is not concentrated sufficiently, the colloidal nitrogen is incompletely precipitated. It is also advisable to add the alcohol with constant stirring while the residue is quite hot. Under these circumstances, the colloidal nitrogen is precipitated in a flocculent condition, is easily transferred to a filter, and should be washed with small quantities of absolute alcohol.

The following table gives the results which were obtained with eleven samples of urine. The specimens were chosen to represent as varied conditions as possible.

No.	T. N	U. N. / T. N.	NH_3.N. / T. N.	Undt. N. / T. N.	Coll.N. / T. N.	Undt.N. / g.	Coll. N. / g.	Coll. N. / Undt.N.	
166	4.3	68.8	7.2	17.3	9.3	0.744	0.406	54.3	Hyperemesis of pregnancy.
170	5.4	59.7	8.1	21.8	13.2	1.170	0.691	60.0	Pregnancy.
179	11.8	81.8	5.2	8.3	5.2	0.980	0.620	62.8	
180	8.1	77.4	4.3	11.8	11.2	0.960	0.920	95.5	Dermatitis herpetiformis.
201	5.5	73.3	2.4	18.0	12.1	1.010	0.670	67.0	Pregnancy. Normal.
239	5.5	82.0	5.0	7.9	5.2	0.440	0.290	65.8	Leukemia in boy aged eleven years.
240	25.0	85.4	5.4	3.9	4.0	0.730	0.750	103.0	Diabetes. Strict diet. No glucose.
242	8.3	79.5	2.4	13.4	10.0	1.940	1.440	74.5	Antepartem.
250	12.0	81.1	5.8	7.2	5.0	0.870	0.600	69.0	Herpes.
251	4.7	72.8	9.4	10.9	7.2	0.510	0.340	66.0	Eclampsia.
252	6.4	72.4	7.7	12.5	7.0	0.820	0.450	54.9	Pregnancy 8th month. Œdema.

[4] Samuely. Ztschr. f. physiol. Chem., 1906, xlvii, 376.

[5] Ewing and Wolf, loc. cit.

The net result of the examination is given in the last column, where the relation of the colloidal nitrogen to the undetermined nitrogen has been worked out. It will be seen that the relation is in no sense a constant one, but varies from 54 per cent. to 103 per cent. In the majority of the specimens the colloidal nitrogen forms about 60 per cent. of the undetermined nitrogen, but in one instance, in which the patient, a diabetic, was consuming large amounts of proteins, the colloidal nitrogen was present in larger amount than the undetermined nitrogen.

It would seem that the variation is much too great to permit one to use the method, even for clinical purposes, either as an equivalent or substitute for the more accurate methods for estimating the undetermined nitrogen.

In the second part of the paper on colloidal nitrogen Salkowski made an examination of the properties of the mixture which is precipitated by alcohol. Among the substances which were found was a nitrogen-containing carbohydrate which did not reduce Fehling's solution, except after inversion with dilute acids or after treatment with ptyalin. In order to confirm Salkowski's interesting observation, we prepared a quantity of the colloidal nitrogen, and subjected it to an examination.

For this purpose, 28 liters of normal urine was evaporated gently on an electric stove, and to the hot residue 5 liters of alcohol was added. The mixture was allowed to stand over night. The residue, consisting chiefly of inorganic salts, was filtered off. The filtrate was evaporated to a syrup, and reprecipitated with a large volume of absolute alcohol. The precipitate was again dissolved in water, evaporated, and precipitated for the third time. The precipitate was collected on a filter, washed with a large quantity of absolute alcohol, and dried in a vacuum. The vacuum-dried residue weighed 2.2 grams. It formed a dark-brown powder which was completely soluble in water.

A qualitative examination of the mixture dissolved in water gave the following results: Xanthoproteic reaction, slight. Biuret reaction, negative. Millon's reaction, brown or reddish-brown precipitate. Adamkiewicz reaction, negative. Picric acid, slight cloudiness. Potassium ferrocyanide and acetic acid, no precipitate. Mercuric chloride, cloudiness. Voluminous red-brown precipitate on heating. Mercurous nitrate, red precipitate in the cold. Lead acetate, brown flocculent precipitate, soluble in acetic acid. Cupric acetate, brown precipitate, soluble in acetic acid. Orthophosphoric acid, 50 per cent., no precipitate. Phosphotungstic and hydrochloric acid, brown voluminous precipitate. Tannic acid, faint precipitate. Ferric ammonium sulphate and sulphuric acid, faint precipitate. Phosphomolybdic acid, brown precipitate. Alkaline lead acetate and heat, no darkening. Ammonio-silver nitrate and heat, no reduction. Molisch's test, exceedingly faint. Haines' solu-

tion, no reduction. Haines' solution after heating solution with hydrochloric acid, no reduction.

The determination of nitrogen and ash in the substances gave the following results: Determination of ash: 0.0278 gram of the substance dried at 110° gave, on ignition, 0.0262 gram of ash = 9.4 per cent. Nitrogen determined by Kjeldahl = 8.5 per cent. Amount of nitrogen in ash-free substance = 9.6 per cent.

As unquestionably a part of the substances which are precipitated by alcohol are the sulphur-containing proteic acids above referred to, it was thought of interest to determine the partition of the sulphur in the substance directly. A portion of the substance was dissolved in water, and the total sulphur, total sulphates, alkaline sulphates, ethereal sulphates, and neutral sulphur were estimated. The analyses gave the following results: Partition of sulphur in the substance: Total sulphur, 1.65 per cent. Total sulphate sulphur = 0.46 per cent., = 27.8 per cent. of total sulphur. Alkaline sulphate sulphur = 0.022 per cent., = 1.33 per cent. of total sulphur. Ethereal sulphate sulphur = 0.44 per cent., = 26.5 per cent. of total sulphur. Neutral sulphur = 1.19 per cent., = 72.2 per cent. of total sulphur.

It will be observed that the greater portion of the sulphur present is in the form of neutral sulphur, to which the proteic acids belong. A not inconsiderable portion is represented by ethereal sulphates, comprising perhaps indoxyl and phenolic sulphates. The amount of inorganic sulphates is about 1 per cent. of the total.

It is interesting to note that the percentage of neutral sulphur does not allow one to form a judgment of the amount of proteic acids present in the colloidal nitrogen. On the one hand, the percentage of neutral sulphur in the substance is, as a whole, greater than the average of the sulphur analyses of the compounds as found by Bondzynski, and the nitrogen content of the colloidal nitrogen as found by us is much lower. One can only conclude, therefore, that in the colloidal nitrogen mixture there are other sulphur-containing compounds which have a much lower sulphur content than the class of proteic acids. What the nature of these compounds is one cannot even conjecture. An attempt was also made by Salkowski to effect a partial separation of the mixture contained in the colloidal nitrogen by means of animal charcoal. We have also repeated his experiments in this direction.

Separation by means of animal charcoal: 0.6 gram of the substance was dissolved in 100 c.c. of water and 5 grams of Kahlbaum's "K" animal charcoal added. The mixture was heated over night on the water-bath and filtered. The filtrate was colorless. The filtrate was tested by the following tests: Molisch's test, faint violet color. Ammoniacal silver nitrate and heat, no mirror. Haines' solution, no reduction. Haines' solution after hydrochloric acid and heat, no reduction. Haines' solution after ten hours in

thermostat at 40° with saliva, no reduction. Iodopotassium iodide, no color change or precipitate. Tannic acid, negative. Murexide test, negative. Biuret test, negative. Lead acetate, white flocculent precipitate on warming.

Analysis of the filtrate for nitrogen and ash: 25 c.c. of solution evaporated and dried at 110° gave 0.0324 gram of residue. Substance gave on ignition 0.0116 gram of ash = 35.8 per cent. Nitrogen in dried residue = 11.7 per cent. = 18.2 per cent. in ash-free substance.

The animal charcoal was extracted with ammoniacal 50 per cent. alcohol. A thick brown liquid was obtained, which with zinc and hydrochloric acid evolved hydrogen sulphide.

In regard to the nitrogenous carbohydrate of Salkowski, it will be seen that we have not been able to confirm his results. While the presence of a carbohydrate group is possible from the faint Molisch test which we obtained, this test is too delicate to conclude that the substance is really a definite part of the colloidal nitrogen. As far as a reducing carbohydrate, which is to be obtained after inversion, is concerned, the tests which were designed to show its presence absolutely failed.

SUMMARY. The colloidal nitrogen of Salkowski does not bear any relation to the undetermined nitrogen. The method cannot be recommended for clinical use. In the mixture precipitated by alcohol from urine the nitrogenous carbohydrate described by Salkowski was not found.

A COMPARATIVE STUDY OF THE OCCULT BLOOD TESTS; A NEW MODIFICATION OF THE GUAIAC REACTION; ITS VALUE IN LEGAL MEDICINE.

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OCCULT blood reactions, chemical reactions for the recognition of minimal hemorrhages into the gastrointestinal tract unrecognizable by the unaided eye, have been the subject of considerable discussion among internists during the last two or three years. It has been but a very short time since much stress has been laid upon the value in the differential diagnosis of gastrointestinal diseases of the recognition of these minimal hemorrhages. Our present knowledge of the subject may be said to date from the appearance of Boas' first article.[1] So little attention was given to this that in

[1] Sammlung klin. Vorträge, February, 1905, Nr. 387. (Many other references.)

his second article which appeared a year later, he expresses surprise that clinicians have neglected what he considers a great advance in our clinical knowledge of these diseases. Practically two years passed before the work was seriously taken up by others, and then followed contributions from Schmilinsky,[2] Joachim, Schloss,[3] Hartmann,[4] Clemm,[5] and a few others, all of whom reassure us of the value of these tests. The history of the original Weber[6] reaction has been one of repeated modifications and a changing of the conception of what is and what is not a proper end reaction.

The tests fortunately are very simple, but experience has taught us that this simplicity must be conducted with decided care, particularly in experimental work. Weber's test and all of its modifications depend upon three definite principles: (1) That changed hemoglobin is soluble in acetic acid, forming acid hematin; (2) that acetic acid solutions of hematin are soluble in sulphuric ether; and (3) that guaiac resin when dissolved and ozonized in a solution of blood causes a typical color reaction. I give herewith the original Weber test and its most important modifications, as well as the Klunge aloin test. For convenience the successive steps in each test have been numbered.

Weber's Test. 1. Five c.c. of stomach contents or a similar amount of softened stool is mixed with one-third its amount of glacial acetic acid.

2. To the above mixture add an excess of ether and allow to extract.

3. To a portion of the resulting extract add ten drops of a freshly prepared tincture of guaiac, and shake thoroughly.

4. Add thirty drops of old turpentine.

If the reaction is positive an intense blue color results. If there is much blood present the ether extract becomes a Tokay color. If there is little blood the ether remains uncolored.

Boas' First Modification of the Weber Test. 1. About 5 c.c. of soft stool is extracted with 20 c.c. of ether to remove the fats.

2. Pour off the resulting extract.

3. Add 2 or 3 c.c. of glacial acetic acid to the remaining stool, and mix thoroughly.

4. Extract with 10 c.c. of ether.

5. Add a few granules of powdered guaiac resin to a portion of the above extract in a test-tube and shake carefully.

6. Add thirty drops of old turpentine.

The main difference is that Boas first extracts with ether to remove the fats that may be present and employs the powdered guaiac in place of the tincture.

[2] Münch. med. Woch., 1903, Nr. 49.
[3] Arch. f. Verdauungskrankheiten, Band x, Heft 3.
[4] Ibid., Band x, Heft 1.
[5] Berl. klin. Woch., 1893. No. 19.
[6] Ibid., Band x, Heft 4.

Boas' Second Modification of the Weber Test. Instead of using old turpentine Boas later recommended the use of dilute hydrogen peroxide—a 3 to 5 per cent. solution. He was then of the opinion that it was not necessary first to remove the fats, and this part of the test was dispensed with. Boas found this method more delicate than the turpentine method.

Rossel advises that when the test is applied to the stomach fluid it should first be neutralized. Boas claims that neutralization is not necessary. This is very easy to demonstrate.

Author's Water Modification. 1. All glassware must be chemically clean and perfectly dry.[7]

2. To one gram of stool which has been softened if necessary by as few drops of water as possible, about 4 or 5 c.c. of glacial acetic acid is added and intimately mixed. This is best accomplished by rubbing up in a glass mortar.

3. To the above mixture add 30 c.c. of ether and allow to extract for several minutes, after thoroughly shaking or mixing.

4. To 1 or 2 c.c. of the extract, which is perfectly clear and can be decanted off, add an equal amount of distilled water and shake thoroughly.

5. To the resulting mixture add a few granules of powdered guaiac resin, an amount that will be held on the tip of a small knife-blade; this is allowed to dissolve and the tube is agitated thoroughly.

6. Thirty drops of old water-white chemically pure turpentine is now added, and thoroughly mixed with the contents of the tube. Set aside against the light or in front of a white surface.

If blood is present to the amount of 1 milligram to 1 gram of stool a distinct light-blue color develops quickly in the upper half of the mixture, remains for a short time, and gradually disappears. Larger amounts of blood cause a more intense blue, but almost always a turbid, or opaque blue, often the color of a turquoise.

NOTE.—If the reaction is intense it may be better seen if about 10 c.c. of ether is added to the original extract. If smaller amounts of blood are present the reaction may assume a smoky grass-green color. (See later.) The reaction may be sometimes intensified by extracting the greater part of the coloring matter with alcohol which

[7] The precaution of absolute dryness is not necessary if comparatively large amounts of blood are present. My assistant, Dr. Roche, obtained a positive blue in the early morning several times by the author's method. Other methods were negative. I was unable to verify the results at 11 A.M., neither could Dr. Roche. We then sought for an explanation. Fearing that the early morning positive reaction was due to contamination of the tubes they were all washed with nitrohydrochloric acid and thoroughly rinsed in distilled water. No reaction occurred in these tubes An old tube that had not been used and which did not look clean was now used and a beautiful blue reaction occurred. New tubes that had not been unwrapped also permitted the reaction to take place. We repeated this experiment many times, always obtaining a reaction in a perfectly dry tube, never obtaining it in a damp tube. The other modifications did not take place in the dry tubes. From this time on a set of tubes was kept thoroughly dry by draining over night and heating in the oven if necessary. The reason for the reaction occurring in the early morning was due to the fact that the tubes had dried over night.

may be filtered off. This makes the test long and it is seldom necessary.

Several other modifications might be mentioned, but on careful perusal they will be found to be unintentional modifications, due to a misconception of the successive steps of the original reaction; when applied to very minute amounts of blood they do not react. As the re-extraction with ether has been shown by Boas and others, and can be easily demonstrated, to be of no importance, it is omitted in the experiments that follow; the difference between the two tests being simply in the oxidizing agent employed. Other variations that have been made are noted.

Aloin Test. Klunge has introduced what is known as the aloin test, the successive steps of which are as follows, the principle of the reaction being the same as the guaiac reaction:

To the acetic acid and ether extract obtained as above, 20 to 30 drops of ozonized turpentine is added. The resulting mixture is now treated with from 10 to 15 drops of a freshly prepared tincture of aloin. (About 3 grains to 5 c.c. of 70 per cent. alcohol.) If blood is present, a beautiful cherry-red color gradually develops, but sometimes requires many minutes. By adding a few drops of chloroform the color change may be hastened and intensified. The cherry-red color usually develops in the bottom layer, which is the aloin layer. At other times the entire contents of the tube are changed to a pink or light cherry color. A contact test results if the aloin solution is allowed to run down the side of the tube. A slight pink color will often develop in an hour's time in the absence of blood. The reaction should occur within one-half hour to be positive. Boas employs this test as confirmatory of the guaiac test. He thinks that at times it is more sensitive than the guaiac test.

EXPERIMENTS.

Series I.—Meat Diet Investigations.

It has been claimed that reactions for occult blood occur in the stools of individuals eating a meat diet, and that for this reason the test should be applied only when the patient is eating a meat-free diet. The purpose of this experiment is, therefore, to inquire into the frequency with which the reactions do occur with the ordinary meal. To this end patients were selected without any reference to their ailment; they were eating the regular hospital diet, which consists of meat at least twice and often three times daily. In an institution where hundreds are being fed the meat is not always thoroughly cooked, that is, rare meat is commonly seen. The conditions, accordingly are well adapted for this experiment.

In all, the stools of thirty-four patients were examined. The

consistency varied from partly formed to those containing hard and dry cylinders. In only two cases were positive results obtained (Cases II and XX). Inquiry disclosed the fact that Case II had had a visible hemorrhage the previous day, and Case XX, in whom there had been no suspicion of hemorrhage, was found on subsequent examination to have postnasal conditions which caused a more or less constant oozing into the digestive tract.

Both the guaiac and the aloin tests were made in each case. The experiment illustrates that the tests are not delicate enough to recognize the small amounts of blood that are swallowed with the uncooked portions of the meat. It can be said that individuals on an ordinary meat diet seldom if ever give a reaction for occult blood, and that if a reaction occurs it is in all probability due to some pathological process in connection with the gastrointestinal canal. In this series the ether extract was very little influenced by the color of the stool.

Since the above tests were made we have tested a large number of stools of patients under the same conditions, and have yet to find a positive reaction due to uncooked meat.

Series II.—Meat Ingestion Experiments.

The following experiments were made in order to gain some idea of the amount of uncooked red meat that must be ingested before a reaction for occult blood can be obtained in the stools, and also to determine the length of time after the ingestion of the meat before the reaction appears and disappears. The meat was prepared by scraping round steak and chopping into it a very small amount of onion, pepper, and salt. No fiber was present. The amounts were weighed on the ordinary laboratory balance, and are of course only approximate, yet are fairly accurate. The method that has been found the most delicate is the one that is recorded.

EXPERIMENT 1.—Mrs. G. 50 grams of scraped beef was given at 11 A.M.; first stool passed in twenty-one hours; water, guaiac, turpentine method was positive; Klunge test was negative. Second stool was not saved.

EXPERIMENT 2.—50 grams of scraped beef was given at 11 A.M. First stool passed in twenty hours; water, guaiac, turpentine method was positive; Klunge aloin test was negative. Second stool passed in forty-two hours; water, guaiac, turpentine method was negative; Klunge aloin test was negative. Third stool passed in seventy-two hours; water, guaiac, turpentine method was negative; Klunge test was negative.

EXPERIMENT 3.—40 grams of scraped beef was given at 11 A.M. First stool passed in twenty-one and a half hours; water, guaiac, turpentine method was positive; Klunge test was negative. Second

stool passed in forty hours; water, guaiac, turpentine method, and Klunge test were negative. Third stool passed in seventy hours; all tests were negative.

EXPERIMENT 4.—Mrs. E. 30 grams of scraped beef was given at 11 A.M. First stool passed in twenty-one hours; water, guaiac, turpentine method was positive; Klunge aloin test was negative. Second stool passed in seventy hours; water, guaiac, turpentine method, and Klunge test were negative.

EXPERIMENT 5.—Mr. E. 20 grams of scraped beef was given at 11 A.M. First stool passed in ten hours; water, guaiac, turpentine method was positive;[3] Klunge aloin test was negative.

EXPERIMENT 6.—Mr. D. 15 grams of scraped beef was given at 11 A.M. First stool passed in twenty hours; water, guaiac, turpentine method was questionable; Klunge aloin test was negative.

EXPERIMENT 7.—Mrs. G. 10 grams of scraped beef was given at 11 A.M. First stool passed in nine and a half hours; water, guaiac, turpentine method was negative; Klunge aloin test was negative. Second stool passed in twenty-four hours; water, guaiac, turpentine method, and Klunge test were negative.

EXPERIMENT 8.—Mr H. Stomach was thoroughly washed and drained. At 11 A.M. 10 grams of chopped beef was given. The first stool was passed in eighteen hours. Hard, brownish-green cylinders one inch in diameter, with no visible blood. Extract, water, guaiac, turpentine method, change to blue-green which faded; extract, guaiac, turpentine method was negative; extract, guaiac, dilute H_2O_2 method, black reaction in upper layer; extract, guaiac, strong H_2O_2 method, black reaction in upper layer. Klunge test gave a positive red in the bottom of the tube in a very few minutes.

EXPERIMENT 9.—Miss S. was given 10 grams of chopped beef. The first stool was passed in twenty-nine hours, yellowish-brown, semisolid. Extract, water, guaiac, turpentine method quick change to light green deepening to grass-green with no blue; extract, guaiac, turpentine method, no reaction; extract, guaiac, dilute H_2O_2 method, a brownish reaction in upper layer; extract, guaiac, strong H_2O_2 method, a black reaction in the upper layer. Klunge test gave a reddish-brown reaction intensified by chloroform. Second stool passed on the following day. Extract, water, guaiac, turpentine method, quick change to light green which gradually deepened and faded with no blue; extract, guaiac, dilute H_2O_2 method, no change; extract, guaiac, strong H_2O_2 method, plum-color reaction which did not fade in two hours; extract, guaiac, turpentine method, no change. Klunge test was absolutely negative after half an hour.

EXPERIMENT 10.—Mrs. J. Stomach was washed and thoroughly drained. 10 grams of chopped beef was given at 11.45 A.M. First

[3] A grass-green color quickly appears, this intensifies to a deep green, and very gradually fades away.

stool was passed in eighteen hours, yellowish-brown dry cylinders; all tests were negative. Second stool was not saved.

CONCLUSIONS. 1. In order that a positive reaction for occult blood be obtained after eating uncooked meat there must have been ingested 10 grams of beef. The smallest amount to give a distinct blue reaction with the guaiac tests was 20 grams. Of five tests below 20 grams the reaction was positive twice, negative three times.

2. The reaction if positive always occurs in the first stool passed after eating the test meal. This occurred in one case as early as ten hours, in another as late as twenty-nine hours. Only once did it occur with the second stool and never with the third stool.

3. The water modification of the guaiac test gives the most uniform results. Both hydrogen peroxide methods and Klunge's test were at times as sensitive as the water modification. The Boas reaction with turpentine is far less sensitive than any of the others. I have been unable after many trials to obtain a reaction with less than 10 grams of beef. Weber reports positive results with 3 grams of meat.

Series III.—Blood and Stool Mixture Experiments.

The purpose of this series of experiments was to determine the sensitiveness of the guaiac and the aloin tests. A definite amount of blood was added to a definite amount of stool. The quantity in each was determined by exact weight. The first three experiments were conducted by calibrating a capillary tube so that the weight of each drop would correspond. Fearing that this was not as accurate as it should be the remaining tests were made by determining exactly the weight of the blood on a very delicate balance with agate bearings and the exclusion of currents of air. The blood in each experiment was always taken from the same person. It was found that in the cases in which the calibrated tube was employed a drop of blood from one person differed in weight from that of another person, but corresponded quite closely with another drop from the same person. For this reason more than one experiment was necessary in order that definite conclusions could be reached.

EXPERIMENT 1.—Drop method. 0.005 gram of blood was added to 1 gram of feces; guaiac, turpentine method was negative; Klunge aloin test was negative. 0.010 gram of blood was added to 1 gram of feces; guaiac, turpentine method was negative; Klunge aloin test was negative. 0.015 gram of blood was added to 1 gram of feces; guaiac, turpentine method was negative; Klunge aloin test was negative. 0.020 gram of blood was added to 1 gram of feces; guaiac, turpentine method gave a distinct greenish color; Klunge aloin test gave a distinct but light cherry color. 0.025 gram of blood was added to 1 gram of stool; guaiac, turpentine method

gave a distinct blue color; Klunge aloin test gave a distinct but light cherry color.

EXPERIMENT 2.—Drop method. 0.005 gram of blood was added to 1 gram of feces; guaiac, turpentine method gave a light greenish tinge; Klunge aloin test gave a questionable pinkiness. 0.010 gram of blood was added to 1 gram of feces; guaiac, turpentine method gave a light greenish color; Klunge aloin test gave a very slight pinkiness. 0.015 gram of blood was added to 1 gram of feces; guaiac, turpentine method gave a questionable color change; Klunge aloin test was questionable. 0.020 gram of blood was added to 1 gram of feces; guaiac, turpentine method gave a positive blue color; Klunge aloin test gave a positive cherry. 0.025 gram of blood was added to 1 gram of feces; guaiac, turpentine method gave a positive blue to purple; Klunge aloin test gave a very positive cherry.

EXPERIMENT 3.—Drop method. 0.005 gram of blood was added to 1 gram of feces; guaiac, turpentine method was negative; Klunge aloin test was negative. 0.010 gram of blood was added to 1 gram of feces; guaiac, turpentine method was negative; Klunge aloin test was negative. 0.015 gram of blood was added to 1 gram of feces; guaiac, turpentine method gave a greenish tinge, positive; aloin test was questionably negative. 0.020 gram of blood was added to 1 gram of feces; guaiac, turpentine method, which gave a distinct pale green, was positive; Klunge aloin test was questionably negative. 0.025 gram of blood was added to 1 gram of feces; guaiac, turpentine method, distinct blue to purple, was positive; Klunge aloin test, distinct but light cherry, was positive.

EXPERIMENT 4.—Exact weight method. 0.002 gram of blood was added to 1 gram of feces; guaiac, turpentine method, no change in color, was negative; Klunge aloin test, no change in color, was negative. 0.003 gram of blood was added to 1 gram of feces; guaiac, turpentine method, no change in color, was negative; Klunge aloin test, no change in color, was negative. 0.004 gram of blood was added to 1 gram of feces; guaiac, turpentine method, light greenish tinge, which faded, was positive; Klunge aloin test, upper portion of tube opalescent, was questionable. 0.005 gram of blood was added to 1 gram of feces; guaiac, turpentine method, light greenish tinge, which faded, was positive; Klunge aloin test, upper portion of tube pinkish, was questionable. 0.006 gram of blood was added to 1 gram of feces; guaiac, turpentine method, distinct light green, which faded, was positive; Klunge aloin test was questionable. 0.007 gram of blood was added to 1 gram of feces; guaiac, turpentine method, distinctly deeper green, which faded, was positive; Klunge aloin test, same as before, was questionable. 0.008 gram of blood was added to 1 gram of feces; guaiac, turpentine method, suggestion of blue, was positive; Klunge aloin test, same as before, was questionable. 0.009 gram of blood was added to 1 gram of feces, guaiac, turpen-

tine method, pale smoky blue, which faded, was positive; Klunge aloin test was questionable. 0.010 gram of blood was added to 1 gram of feces; guaiac, turpentine method, pale blue, which faded, was positive; Klunge aloin test, same as before, was questionable. 0.015 gram of blood was added to 1 gram of feces; guaiac, turpentine method, deep purple-blue, which faded, was positive; Klunge aloin test, same as before, was questionable.

EXPERIMENT 5.—Exact weight method. 0.002 gram of blood was added to 1 gram of feces; guaiac, turpentine method, no change in color, was negative; Klunge aloin test, no change in color, was negative. 0.005 gram of blood was added to 1 gram of feces; guaiac, turpentine method, light greenish color, which faded, was positive; Klunge aloin test, no change in color, was negative. 0.010 gram of blood was added to 1 gram of feces; guaiac, turpentine method, positive green to blue, which faded, was positive; Klunge aloin test, no change in color, was negative. 0.015 gram of blood was added to 1 gram of feces; guaiac, turpentine method, deep purple blue, which faded slowly, was positive; Klunge aloin test, questionable pinkiness, was questionable.

EXPERIMENT 6.—Exact weight method. 0.004 gram of blood was added to 1 gram of feces; guaiac turpentine method, quick change to light green which gradually changed to smoky blue, was positive; guaiac, dilute peroxide method, quick change to light green, which very quickly faded without a suggestion of blue, was positive; water, guaiac, turpentine method, which gave a beautiful light blue, appeared and gradually faded, was positive; Klunge aloin test, no change in color, was negative. 0.003 gram of blood was added to 1 gram of feces; guaiac, turpentine method, absolutely no change in color, was negative; guaiac, dilute peroxide method, very quick change to grass-green, no suggestion of blue, was positive; water, guaiac, turpentine method, immediate change to greenish-blue which gradually changed to a pale blue having a green quality, was positive; Klunge aloin test, no change in color, was negative. 0.002 gram of blood added to 1 gram of feces; guaiac, turpentine method was absolutely negative; guaiac, dilute peroxide method, no change in color, was negative; water, guaiac, turpentine method, which gave a distinct, quickly appearing flat green with a suggestion of blue, which faded, was positive; Klunge aloin test gave no change, was negative. 0.001 gram of blood added to 1 gram of feces; guaiac, turpentine method, which gave a very delicate green color which faded, was positive; guaiac, dilute peroxide method, gave no change in color, was negative; water, turpentine, guaiac method, which gave a beautiful sky blue which faded, was positive; Klunge aloin test, which gave no change in color, was negative. 0.0005 gram of blood added to 1 gram of feces; guaiac, turpentine method, which gave no change, was negative; guaiac, dilute peroxide method, which gave no change, was negative; water,

guaiac, turpentine method, which gave a very faint tinge of green but no blue, faded, was positive.

This patient's stools had been tested for several days previous to the experiment, as a control. They had always given a negative reaction with all tests. The stool with which this experiment was made was soft, formed, and of a light-yellow color.

EXPERIMENT 7.—Exact weight method. 0.004 gram of blood was added to 1 gram of feces; guaiac, turpentine method, light green changing to smoky blue, was positive; guaiac, dilute peroxide of hydrogen, pale green appeared quickly and soon disappeared, with no blue, was positive; water, guaiac, turpentine method, which gave a beautiful blue, which faded, was positive; Klunge aloin test, which gave no change, was negative. 0.003 gram of blood was added to 1 gram of feces; guaiac, turpentine method, which gave no change of color after repeated tests, was negative; guaiac, dilute hydrogen peroxide, which gave a very quick change to a distinct grass green, with no blue, was positive; water, guaiac, turpentine method,which gave an immediate change to greenish-blue, gradually developing a pale-blue color which faded, was positive; Klunge aloin test, which gave no change in color, was negative. 0.002 gram of blood was added to 1 gram of feces; guaiac, turpentine method which gave no change, was negative; guaiac, hydrogen peroxide method, which gave no change, was negative; water, guaiac, turpentine method, which gave a distinct and quickly appearing cloudy green with a suggestion of blue which faded, was positive; Klunge aloin test, no change, was negative. 0.001 gram of blood was added to 1 gram of feces; guaiac, turpentine method, which gave no change of color, was negative; guaiac, dilute hydrogen peroxide method, which gave no change, was negative; water, guaiac, turpentine method, which gave a beautiful sky blue, which gradually appeared and disappeared, was positive; Klunge aloin test was negative. 0.0005 gram of blood was added to 1 gram of feces; guaiac, turpentine method, was negative; guaiac, dilute peroxide method, was negative; water, guaiac, turpentine method, which gave a beautiful delicate sky blue color, which faded, was positive; Klunge aloin test was negative.

The stool with which all these tests were made was of a light-yellow color and thoroughly soft throughout. It was a semiformed stool and the blood could be triturated into it in a most thorough manner.

EXPERIMENT 8.—0.0004 gram of blood, by exact weight, was added to 1 gram of stool and very thoroughly mixed; turpentine, guaiac method (Boas) was absolutely negative; guaiac and dilute hydrogen peroxide method (Boas) was negative; author's water, guaiac, and turpentine method showed a distinct blue ring on the top of the liquid; Klunge aloin reaction was absolutely negative; control was negative.

EXPERIMENT 9.—0.00035 gram of blood, by exact weight, was added to 1 gram of feces, and thoroughly mixed; guaiac, turpentine method (Boas) was negative; guaiac, dilute hydrogen peroxide method (Boas) was negative; guaiac, undilute hydrogen peroxide was negative; author's water, guaiac, and turpentine method showed a faint but distinct greenish color in the top of the liquid which quickly appeared and gradually disappeared; Klunge test was negative; control was negative. Below this dilution the water method failed.

CONCLUSIONS. From the foregoing experiments the following deductions can be made:

1. The guaiac reaction in all of its modifications is constantly markedly more sensitive than the Klunge aloin reaction. There are times when the aloin reaction seems as sensitive as the guaiac (Experiment 1), but the drop method is not trustworthy.

2. The limit of sensitiveness of the original Boas turpentine method is 0.004 gram of blood per gram of feces. Under certain circumstances it may recognize 0.001 gram of blood per gram of stool (Experiment 6).

3. The limit of sensitiveness of the Boas test when dilute hydrogen peroxide is used is 0.003 gram of blood per gram of stool.

4. The limit of sensitiveness of the author's water and turpentine modification is 0.00035 gram of blood per gram of feces.

5. A color that appears and gradually fades is the crucial test of a positive guaiac reaction.

6. The limit of sensitiveness of the Klunge aloin test is 0.02 gram of blood in 1 gram of feces. Under certain conditions, as in Experiments 4 and 5, a questionable or very faint reaction occurs with 0.015 and 0.004 gram respectively.

7. Most authors agree that it is necessary to obtain a distinct blue color before the reaction can be called positive. Schmilinski,[9] however, is not of this opinion. He regards all shades that develop from a deep green to a reddish brown changing into a violet in which the red is more prominent, and finally the blue predominates as positive as the blue itself. My experience enables me to confirm Schmilinski's contention, as well as to carry it a step farther, and say that all colors that result, from a light distinct tinge of green to green, green to deep green in which at times, but seldom, there is a reddish quality, light violet to blue, or deep blue to indigo blue, are positive evidence that blood is present.

8. The color index may be used as an approximate means of estimating the extent of the hemorrhage. In this series of experiments there was never a change in color with the control, nor was there ever a change in color in the many stools we have examined in the laboratory and marked negative. There was no change,

[9] Münch. med. Woch., 1903, Nr. 49.

whatsoever, in any experiment until at least 0.00035 gram of blood was added to 1 gram of feces. The first change that was observed was always a light green which became intensified and changed to blue proportionately as the amount of blood per gram was increased. (In one case which showed occult hemorrhages with marked reaction, as the condition subsided the reaction became fainter and fainter until a light green was all that could be obtained, and this eventually disappeared. This is another evidence that the green color is positive of blood.) It may be said that if a light green to a distinct green color develops, a hemorrhage sufficient to mix intimately 0.0005 gram of blood with every gram of feces has occurred; that if a strong reaction is obtained 0.001 gram of blood is present in each gram of feces. As has been shown by the experiments with ingested blood, such a hemorrhage must have amounted to at least 0.5 to 1 gram, provided that it took place in the stomach or jejunum or at some point above these parts.

Series IV.—Blood Ingestion Experiments.

The purpose of this series of experiments was: (1) To determine the amount of human blood that must enter the intestine from the mouth or stomach before a reaction for occult blood will be obtained in the feces. (2) To determine the time that elapses after the ingestion before the reaction is positive. (3) To determine the time that elapses after the appearance of the reaction until it disappears. (4) To determine the comparative sensitiveness of the modifications of the guaiac test and of the aloin test.

To this end blood was taken from the finger of a perfectly healthy person, always from the same person, carefully weighed on a common laboratory balance which weighs quite accurately to tenths of a gram, and quickly mixed with a whisky-glassful of water. The patient was given the contents of the glass to drink, after which it was rinsed and the rinse water swallowed. The stools of these patients were controlled for several days previous to the experiment and were found to be negative. After the ingestion of the blood all bowel movements were saved and the time of their occurrence marked. Sometimes several hours passed before the test was made. It was found, however, that in stools showing reactions for very minute amounts of blood the reaction was not less positive by ageing them for twenty-four hours or more. The results are as follows:

EXPERIMENT 1.—Mr. D. 2 grams of blood was given at 11.45 A.M. First stool passed in fifteen and three-quarter hours; constipated; guaiac, turpentine method (Boas) was negative; guaiac, dilute H_2O_2, negative; guaiac, undilute H_2O_2, negative; author's water, guaiac, and turpentine method, gave a beautiful blue color. Second stool passed in forty-eight hours; guaiac, turpentine method

(Boas) was negative; all other modifications and Klunge aloin test were negative.

EXPERIMENT 2.—Mrs. E. 1 gram of blood was given at 11.30 A.M. First stool twenty-one hours; constipated; guaiac turpentine method (Boas) was negative; all other modifications and Klunge aloin test were negative. Second stool passed in forty-six hours; all tests were negative. Third stool passed in seventy-three hours; all tests were negative.

EXPERIMENT 3.—Mr. A. 1 gram of blood. First stool, passed in eighteen hours, was formed; author's water method and dilute H_2O_2 method were positive; all other methods were negative. Second stool was passed some hours later, time record lost; all methods were negative.

EXPERIMENT 4.—Mrs. C. 0.5 gram of blood was given at 11.30 A.M. First stool was passed in eighteen and one-half hours; slightly constipated; water, guaiac, turpentine method gave a delicate green color, developed slowly, gradually changed to a distinct grass green, and slowly disappeared, was positive; all other methods though repeated several times showed no change of color whatsoever.

EXPERIMENT 5.—Mrs. B. 0.5 gram of blood was given at 11.40 A.M. First stool was passed in seventeen and three-quarter hours, hard; guaiac, water, turpentine method gave a pale-green color, but not a typical reaction; all other methods gave no change of color. Second stool was passed in thirty-nine hours; all methods negative.

EXPERIMENT 6.—Miss S. 0.5 gram of blood was given at 11.20 A.M. First stool was passed in four and one-quarter hours, mushy; all methods were absolutely negative. Second stool was passed in eighteen and one-half hours, soft; all methods were negative.

EXPERIMENT 7.—Miss B. 0.5 gram (fine balance) of blood was given at 3 P.M. First stool was passed in thirteen hours, dark brown and formed; all methods were negative. Second stool was also negative to all tests.

EXPERIMENT 8.—Mr. S. 0.5 gram of blood, fine balance, given at 9.25 A.M. First stool was passed in twenty-one hours, brown, and mushy, all methods were negative. The second stool was also negative.

CONCLUSIONS. 1. In order that a positive reaction for occult blood occur in the stools after a hemorrhage from the œsophagus or the stomach the hemorrhage must amount to 0.5 gram. With such a hemorrhage only a very faint reaction is present. With a gram of blood a decided reaction is always present.

2. The reaction always occurred in the first stool passed after the blood ingestion. The earliest reaction was obtained fifteen and three-quarter hours after ingestion.

3. The reaction was never present in the second stool passed after ingestion.

4. In this series the water, guaiac, turpentine method was

much more sensitive than any of the other modifications. Next in point of sensitiveness was the guaiac and dilute hydrogen peroxide method. The aloin reaction did not take place in any case.

The foregoing study illustrates the peculiar diversity of results that may be obtained with the different occult blood tests, and at times by the same test, when very minute amounts of blood are dealt with. This not only holds true with feces and blood mixtures but also with stools after the ingestion of blood. In the former case it seems as if the character of the stool has something to do with the sensitiveness of the reaction. A stool with a comparatively large water content, that is, a soft, mushy stool, permits of the recognition of smaller amounts of blood than does a pasty or dry stool. Yet there is a limit to the amount of water that may be added to a pasty stool. In the cases of blood ingestion, it was thought that possibly variations in the sensitiveness of the reaction in different individuals was due to variations in their respective digestive power or to variations in the rapidity with which the food is propelled along the gastrointestinal canal. Thus it was thought that in cases of achlorhydria possibly occult blood would be detected in smaller amounts than in cases of hyperchlorhydria, and that in cases of hypermotility it would be recognized in smaller amounts than in cases showing normal motility or stasis. I soon found that there was nothing in this view, and that after digesting small amounts of blood in test-tubes with stomach fluids of strong digestive power the test was as positive in these tubes as in the control. If, on the other hand, the blood was diluted with water, boiled, and then added to the gastric fluid no occult blood test occurred. The action of the digestive juices has practically nothing to do with the hindrance of the occurrence of the reaction, as has been claimed. The reason for the occurrence of occult blood in cases of achlorhydria is because in this condition erosion is very frequently present.

The character of the stool seemed to have little relation to the sensitiveness of the reaction in the ingestion experiments, as it occurred as readily in a hard dry stool as in a soft one. But these peculiarities are doubtless responsible for the diversity of results obtained by various experimenters. Weber found that after 3 grams of uncooked beef a reaction occurred. I have been unable to verify this contention after many trials, not only with Weber's test, but with other modifications which have always proved more sensitive. Joachim found that 3 grams of ingested blood gave the reaction. With the water modification I was able to get a distinct reaction with 0.5 gram of ingested blood, but was also unable to obtain it with any other test. Schloss obtained a positive reaction when he added 0.0008 to 0.0006 gram of blood to a given amount of stool. Kochmann and Boas obtained a reaction with 0.0008 gram, while

Hartmann obtained it with 0.0001 gram. Schloss is inclined to disbelieve Hartmann's contention and I am unable to demonstrate a reaction with these amounts after many trials. From the diversity of results I have obtained in other experiments, being able to detect with the Boas and Weber tests even smaller amounts of blood than many of these observers have, and still smaller amounts at times with the water modification, I am inclined to believe that the results of all of these men are correct, and that it is possible to detect the minute amount reported by Schloss, if the proper conditions present themselves. In the majority of instances the Boas test with turpentine is made much more sensitive by the addition of water before adding the guaiac resin.

THE RECOGNITION OF MINUTE BLOOD-STAINS ON CLOTHING.

For the recognition of small fresh or dried blood-stains on clothing or other fabrics, I have found the following method to be very sensitive. The test so frequently referred to in works on legal medicine, and often described as Taylor's guaiac method, has not proved as sensitive.

1. Cut out the stain with a pair of scissors.
2. Add from 2 to 10 drops of water according to the size of the stain and rub thoroughly with a glass rod.
3. Add from 2 to 10 drops of glacial acetic acid and mix thoroughly.
4. Add to the resulting solution 1 to 2 c.c. of ether.
5. To the ether extract add a few granules of guaiac resin.
6. Add 20 to 30 drops of old water-white turpentine.

If the stain is due to blood a beautiful blue color develops, continues for about five minutes, sometimes longer, and gradually fades.

Much care must be observed in working with small blood-stains. Too much ether and water dilute the hemoglobin. I have been able to demonstrate a beautiful blue reaction with stains several months old, so small and so thin as to be almost unrecognizable —mere light-brown discolorations. The value of so sensitive a test in legal medicine will be apparent. It does not, of course, differentiate human from lower animal blood. If a stain is large the article tested can then be treated according to the directions given for stool examinations.

General Conclusions. 1. Individuals eating an ordinary meat diet seldom give a reaction in the stools with the occult blood tests. If a reaction occurs it is in all probability due to some pathological process in connection with the gastrointestinal tract.

2. For a positive reaction to occur from the ingestion of uncooked meat, 10 grams must have been eaten; usually 20 grams.

3. For a reaction to occur in the stools after a hemorrhage from

the œsophagus or stomach, the hemorrhage must have amounted to at least 0.5 gram. With such a hemorrhage only a faint reaction is obtained. With 1 gram of blood a decided reaction occurs.

4. The reaction always occurs in the first stool passed after the ingestion of pure blood or of food containing free blood. It seldom occurs in the second stool. It may occur as early as ten, and as late as twenty-one, hours after ingestion.

5. The sensitiveness of the guaiac reaction is greatly enhanced if an equal amount of water is added to the ether extract employed, before the addition of the guaiac and turpentine.

6. The diversity of results obtained by various writers and myself, leads to the conclusion that the results obtained by all can be duplicated if the proper conditions present themselves. In other words, when very minute amounts of blood are present a great variety of results will be obtained by all tests, with the same amount of blood, if experiments are made on successive days.

7. The water modification is uniformly more sensitive than the Weber, Boas, or Klunge tests. All of the guaiac tests are more sensitive than the aloin test.

8. A gradually appearing and fading color is the crucial test of a positive reaction. Any color, from a pale green to deep violet, that develops and fades, is positive.

9. In medicolegal cases, when the question arises as to the nature of minute stains on articles of clothing, paper, etc., the water modification of the guaiac reaction will be found to be more sensitive than the Taylor method, so frequently referred to in works on legal medicine, and its application is very simple.

VARICOSE ANEURYSM OF THE AORTA AND SUPERIOR VENA CAVA.

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On Monday, February 25, 1905, on entering the wards of the Buffalo General Hospital, my attention was at once attracted by the unusual and startling appearance of a patient occupying one of the near beds. He was a large man, in a recumbent position, with a most striking cyanosis of the head, neck, hands, and part of the chest, exposed by his open shirt. He was not blue, but his color was blue-black, of a degree which cannot well be exaggerated. His face was swollen, his eyes closed by œdematous lids. On approaching him I was surprised to find him conscious, and not as distressed and dyspneic as his appearance would lead one to

expect. On being addressed, he opened his eyes and gave me a full history in a dull, indifferent, although intelligent manner.

I shall pass over his family history and remōte personal history, which throw no light on the condition in which I found him. He told me that for four or five years he had been short of breath on exertion, and had had pain over the precordium. He never had dizziness or œdema of the legs. He said that on the previous Saturday he was at work on Lake Erie, harvesting ice; that in lifting a heavy piece he felt a sudden sharp pain in the right mammary and infraclavicular regions, and felt as if blood or water were rushing up his neck and head on the right side. He became very weak and dizzy, and had to stop work. His neck and face began to swell and felt cold. He had pain in the right chest all the next day, and when he went to bed he noticed that his hands and face were blue. The next day he had mild headache and humming in the ears. He said his vision was somewhat impaired; objects appeared darker than usual. He felt tired and sleepy all day. His bowels did not move and he urinated frequently, small quantities at a time. Later in the day he was admitted to the hospital.

I made a physical examination and quote the following notes made at that time:

A large-framed, well-built, rather plethoric man, aged forty-nine years, with face, head, neck, upper extremities, and thorax extremely cyanosed—almost black—and œdematous. The blue-black color terminates rather abruptly on a line with the diaphragm. His eyes are somewhat bulging—conjunctivæ congested. The veins of the neck, thorax, and abdomen are dilated and tortuous. The blood in the veins flows downward. A heaving impulse is felt in the second, third, and fourth intercostal spaces to the right of the sternum. The sternum is also heaving. The impulse is most marked in the second intercostal space, two-and-one-half inches from the midsternum. The apex is palpable in the sixth interspace one inch outside the nipple line.

The area of cardiac dulness extends one-half inch outside the nipple line. An area of dulness is found in the second, third, and fourth interspaces to the right of the sternum, and two-and-one-quarter inches to the left of the midsternum. There is a systolic murmur at the apex, a diastolic murmur over the aortic area and down the sternum, and a loud systolic souffle over the anterior chest and to the right of the sternum, loudest in second interspace and transmitted to the vessels of the neck and arm and audible also in the abdominal aorta. There is no appreciable tracheal tug. Phonation is harsh. The posterior veins are dilated and tortuous. The percussion note is higher pitched on the right side from above down to the seventh interspace. There is some tenderness in the interscapular area upon deep pressure. A loud systolic souffle is heard posteriorly on both sides, but most distinctly on the right

side, and as low down as the crest of the ilium. There is a very slight cyanosis of the lower extremities, due to stasis.

February 28. The condition remains materially unchanged. The patient shows a little more apathy, and quite a little more œdema of the chest and head.

February 29. The patient was presented to the class in the hospital clinic. At this time all of his symptoms were carefully reviewed and verified. No additional notes were made except that there was an absolute want of arterial pulsation in the enlarged and full veins of the neck. Blood examination showed: Hemoglobin 100 per cent.+; erythrocytes, 6,200,000; leukocytes, 20,000. Urine analysis: slight acidity; albumin, a good trace. Microscopically, there were many small hyaline casts and pus cells. Ophthalmoscopic examination by Dr. Burrows was negative; there was decided increased tension of both eyes (glaucoma).

The signs presented by the patient made it plain that there was an aortic aneurysm, with occlusion of the superior vena cava; but my associate, Dr. Lyon, who saw the patient with me at the time of my first examination, was quick to reach the correct conclusion—that it was a rupture of the aorta into the vena cava. I concurred in the diagnosis, owing to the sudden development of the graver symptoms, which could not be accounted for by aneurysmal dilatation. Reference to the cases reported by Pepper and Griffith,[1] and again by Stengel,[2] made it clear that the case was classic in every detail.

February 30. The œdema increased, breathing became more labored, the hue, if possible, blacker, and the patient died on the fifth day after the onset of his graver symptoms. His temperature ranged between 97.0° and 95°; pulse 120 on admission, gradually declined to 85 before death.

The autopsy revealed the following conditions: Lividity marked; pericardium contained about 200 c.c of serous fluid; the heart, itself, was large and flabby; the mitral valve was normal; the aortic leaflets were thickened; the aorta was calcareous, thick, and on its ascending portion was found an aneurysm extending to the right, and beginning about one inch above the aortic orifice; the sac was about the size of a large fist, and was adherent to the right lung and the superior vena cava. The cava was occluded from a point three-quarters of an inch above the orifice to about two inches above it; the internal walls of the cava were adherent to each other. A small opening about the size of a No. 10 catheter joined the sac and the superior vena cava above the occlusion. The pleural cavity contained serous fluid; the right lung was adherent to the sac and the superior vena cava.

[1] Trans. Assoc. Amer. Phys., 1890, v, 450.

[2] Ibid., 1900, xv, 532.

THE NATURE OF THE GENERAL TOXIC REACTION FOLLOWING EXPOSURE TO THE X-RAYS.

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In the course of the last few years evidence has been accumulating that *x*-ray exposures may have seriously undesirable effects upon the tissues in the interior of the body, as well as upon the skin and other superficial structures; and of these evil effects that which arouses most marked attention, because it is most dangerous, is the more or less profound and sometimes fatal reaction that has occasionally been observed soon after exposure, and that is characterized chiefly by signs indicating an acute intoxication. It would be superfluous to review the evidence demonstrating the occurrence of such reactions and their definite relation to *x*-ray exposures. Both these points have been shown with sufficient clearness, and both are generally accepted. We have ourselves seen three cases in which a most severe reaction occurred after one exposure to the *x*-rays; two of these cases ended fatally a short time afterward, while the third patient became profoundly ill, but ultimately recovered. In two of these cases the exposure to the *x*-rays was ordered by colleagues; in the other, we were ourselves responsbile for its use.

Since the *x*-rays are of great importance in the diagnosis of many conditions, and apparently also of considerable therapeutic value, it is most earnestly to be desired that the character of the disturbance producing these occasional toxic reactions be determined, in order that we may thereby attempt to devise a well-founded method of preventing the reactions, while still continuing to use the *x*-rays, when they are in place. We have had the rather remarkable fortune of having studied the conditions of metabolism in two such cases, just before, during, and after violent reactions; the cases having been subjected to study for other reasons, and without, of course, any expectation that reactions would occur. We have by this chance been enabled to determine the alterations in metabolism at the time of the reaction, and have obtained results that seem to demonstrate the general nature of the reaction and to sound a warning against the use of the *x*-rays in certain kinds of cases. With us, indeed, these results will constitute a prohibition against the use of *x*-rays in such cases until, at any rate, our knowledge becomes

more exact, unless most urgent and exceptional reasons seem to justify us in running some risk in occasional instances.

The cases do not require extended clinical description, and, because both may be reported for other reasons by those who had clinical charge of them, we shall give only the details essential to our purpose.

CASE I.—A man, aged forty-three years, with pernicious anemia, was seen in Dr. Stengel's service at the University Hospital. During several weeks of treatment with the usual measures he grew gradually but persistently worse. Owing to the successful results previously observed by Dr. Elliston Morris and one of us in a case of pernicious enemia that was resistant to ordinary treatment, but that improved to a remarkable degree under exposures to the *x*-rays, it was suggested that this agent be tried in this case. At the same time, however, it was urged that the exposure be brief and mild, because in another case of pernicious anemia in which a single exposure had been ordered by Dr. D. J. Milton Miller, which case, as well as that last mentioned, has previously been briefly reported,[1] a violent reaction occurred. It should be especially noted, for reasons that will soon be apparent, that when the exposure occurred, and for some time before, the man presented slight fever, nausea, prostration, and other evidences of a noteworthy degree of intoxication. His exposure was partly over the thighs and partly over the splenic region, its duration was, all told, only five minutes, and its intensity was very mild. Dr. Pancoast, who gave it, informed us that it was as mild an exposure as he had ever administered.

In spite of this caution, about four hours afterward the man became evidently very ill and had a chill. His temperature rose to 103.4°, his pulse became rapid and weak, and he was much prostrated. The fever and prostration continued the next day, and for a week afterward he refused to eat on account of anorexia and more or less nausea. His temperature gradually declined to the previous level and he improved a little, but the gain was, at most, very slight, and while he was still desperately ill his family insisted, about three weeks after the occurrence of the reaction, upon removing him to his home, which was several hours' journey distant, and he died on the train.

The figures for his metabolism follow: It is to be noted that, beginning with the day after the exposure to the *x*-rays, the intake dropped to a very low point. Two days later he refused all food, and the only method of nourishment was through nutritive enemas. We did not determine the amount absorbed, and therefore give no figures for the intake; but from our previous observations on

[1] Musser and Edsall. Trans. Assoc. Amer. Phys., 1905; Univ. Penna. Med. Bull., September, 1905.

this point and from the fact that he retained his enemas poorly, there is little doubt that the amount of nitrogen absorbed was not above 2.5 grams. The figures given at the end of the table are also not absolutely accurate, as the food at this time could not be so carefully controlled, but they are reasonably accurate and certainly sufficiently generous. The drop in the intake is a point of importance, as will be noted later. The "x" in the second column in the table indicates the date of exposure to the *x*-rays.

TABLE I.—URINE.

Date.	*x*-ray exposures.	Nitrogen ingested. Grams.	Nitrogen.	Uric acid.	Phosphates.
Oct. 9	...	10.18	13.892	0.9192	1.170
" 10	...	11.20	14.346	0.9200	1.210
" 11	x	11.83	14.496	0.9594	1.680
" 12	...	9.76	8.400	0.4500	1.164
" 13	...	3.40	10.668	0.4908	2.745
" 14	...	2.50	12.096	0.7630	1.680
" 15	...	...	12.623	0.8376	1.200
" 17	...	...	16.128	0.9292	1.476
" 18	...	...	11.028	0.8769	1.440
" 21	...	...	12.096	0.7406	1.575
" 24	...	2.20	13.608	0.6255	2.131
" 26	...	3.60	11.092	0.8495	1.480
" 31	...	3.00	13.440	0.6836	1.456
Nov. 2	...	2.00	8.400	0.498	1.728

CASE II.—This man, aged fifty-two years, who presented the typical lesions of rheumatoid arthritis, was under the care of Dr. Charles W. Burr, at the Philadelphia Hospital. *x*-ray exposures were ordered by Dr. Burr for the purpose of treating his joint condition; only one such exposure was given, however, owing to the violent illness that followed it. His direct exposure was confined to one arm, from above the elbow down to and including the hand, and was only five minutes in duration; the arm was lying well out from the body, but as the trunk was not screened he got a diffuse and more or less distant exposure of the whole person. It is to be noted in this case, also, that the man was somewhat toxic, having for some time had slight fever, moderate prostration, and occasionally a little delirium at night. These symptoms were apparently the result of a rather severe chronic cystitis. He had no evidence of disease of the kidneys.

After the exposure the temperature rose slightly and he became evidently worse than he had been before. On the second day he was decidedly more prostrated, his temperature was more elevated, and his condition was serious. On the third day he was so much worse that it was thought that he was moribund, and on this day it was impossible to collect his urine accurately, so that the figures for this day are absent. After this he began to mend distinctly, and in a few days had returned to about the condition that he was in before the exposure. The figures for his metabolism follow:

TABLE II.—URINE.

Date.	x-ray exposures.	Nitrogen ingested. Grams.	Nitrogen.	Chlorides.	Uric acid.	Phosphates.
Mar. 21	...	12.55	10.1848	6.267	0.1445	1.620
" 22	...	14.10	11.667	6.555	0.3363	1.440
" 23	...	14.45	11.177	4.000	0.3730	1.624
" 24	...	12.74	8.969	3.175	0.4078	1.576
" 25	...	13.34	11.088	6.800	0.4912	1.370
" 26	x	13.22	10.164	6.000	0.4762	1.450
" 27	...	11.85	8.920	4.545	0.4117	1.170
" 28	...	11.96	11.180	8.300	0.6198	1.650
" 29	...	13.24	5.376	4.100	0.2810	0.760
" 30	...	12.26	16.296	7.250	0.7835	2.080
" 31	...	...	Lost	appeared	moribund	
April 1	...	12.15	10.2816	4.330	0.5568	
" 2	...	12.96	7.774	...	0.3318	

The chief point to be noted in regard to the metabolism in these two cases is the remarkable drop in the excretion that followed the exposure, this drop being followed subsequently by an equally striking rise in the excretion to a point much beyond that at which it had previously been. In the first case, the drop occurred directly after the exposure; in the second, it was postponed for two days, but occurred, as in the first case, at the time when the man had become seriously ill. The figures for the intake demonstrate that in neither instance was this drop due to a reduction of the food, for the reduction in the first case occurred after the drop took place, and in the second case there was no marked change in the intake. Likewise, the subsequent rise was not due to the intake, for in the first case the intake was, on the contrary, at this period, very greatly reduced, and in the second case it was not increased. The importance of the great reduction in intake in the first case becomes evident in this connection—the man's excretion from the time of the reaction on must be compared with this reduced intake, and not with the previous intake, in order to appreciate the conditions of metabolism that were actually present at that time.

The only apparent explanation of these changes in metabolism is the following: Previous work has shown that in cases that respond favorably to the action of the *x*-rays an increase in tissue-destruction, that may be of remarkable extent, occurs directly after exposure to the rays. It appears to us that in these cases this occurred: that the organism was overwhelmed by the sudden necessity for carrying on the complete disintegration of a mass of early products of tissue destruction, and that after a little time, as the organism reacted somewhat, complete disintegration could be accomplished and the products were excreted. At first, therefore, owing to sudden severe overtaxing of the organism, metabolism was apparently halted; but the reduction in excretion seems to have been due to mere retention of incompletely decomposed tissue products, and the usual reaction, which is characterized by marked tissue destruction, appears actually to have occurred, though slow in making

itself evident, for the later figures show conditions that are quite[2] comparable to those seen in two unresolved pneumonia cases, and in a successful case of leukemia[3] previously reported.

In the first case, in which the reaction was much more severe and certainly hastened death, failure of metabolism occurred at once. In the second case there appears to have been at first some difficulty in getting rid of the tissue products and then an attempt to respond to the action of the *x*-rays, for the excretion rose decidedly on the second day after exposure. But after this a metabolic collapse seems to have occurred, and there was a marked drop in excretion, coincidently with the man's grave symptoms, and this was followed by a very striking output as the condition improved. This latter case is of especial interest in that it perhaps offers an explanation of late toxic reactions; that is, the organism bears up at first under the extra strain, but, sooner or later, collapses as a result of its increased burdens.

We have insisted somewhat upon the fact that both the patients now under discussion appeared to be already the subjects of a noteworthy degree of toxemia. This fact seems to us to help in the explanation of the nature of the reaction and also to offer a probable explanation of the fact that a toxic reaction occurs only occasionally. We believe, from these and other experiences, that a toxic reaction i particularly likely to occur in persons that are already the subjects of a toxemia. Their organisms are already taxed to a considerable degree, and sometimes severely, in attempting to control the intoxication that is already present, and, if to this strain is added the metabolic labor of carrying out the complete decomposition of a large amount of tissue products, it seems quite natural that metabolism should occasionally, in the cases most severely taxed by this, suffer more or less complete collapse; and that, in consequence, the signs of severe intoxication should appear.

This is particularly likely to be true, because the tissue destruction accomplished by the *x*-rays undoubtedly involves chiefly tissues that are especially rich in nucleoprotein. The decomposition products of this form of protein are especially rich in substances that are, of themselves, more or less toxic and also difficult to metabolize and excrete. The figures for the first case, particularly, show that the man soon regained his ability to excrete the main portion of the urinary nitrogen, which comes chiefly from the simpler proteins; and also his ability to excrete phosphates. The uric acid, however, which is the direct indicator of the conditions in regard to the nuclein substances (the products of which are more toxic and more difficult to metabolize and excrete), only slowly regained its previous level. In appreciating the latter point, it should be remembered that the diet was purin-free; and hence that, while changes in the

[2] AMER. JOUR. MED. SCI., 1907, cxxxiii, 286. [3] Musser and Edsall, loc cit.

intake influenced the excretion of nitrogen and phosphates, they did not influence the uric-acid excretion.

The nature of the toxic reaction to the *x*-rays would then appear to us to be a sudden demand upon the organism for the complete disintegration and excretion of a large amount of the products of tissue breakdown, with inability on the part of the organism to accomplish this, and a consequent halting of metabolism, resulting in an intoxication produced by incompletely disintegrated tissue remnants. That the intoxication in these cases was not dependent directly upon alterations in the excreting power of the kidneys, but upon alterations in metabolism, appears to be at least highly probable, because examination of the urine of these two patients, at the time of the reaction, and for several days afterward, showed no evidence of irritation of the kidneys. It is, however, undoubtedly very probable that in many instances, after a little time, the kidneys do become overtaxed by the added labor thrown upon them, and their excretory power fails to a greater or less degree, and this may increase the toxic symptoms. It is possible, indeed, that moderate but increasing failure of metabolism, together with increasing failure of kidney function, may cause a late accumulation of toxic symptoms and give rise to the late toxic reactions that have been seen both in human cases and in experiments on animals. It seems evident, at any rate, that such symptoms are more likely to occur not only in those that have severe metabolic or infectious intoxications, but likewise in those that have pre-existing kidney disease; and it has, indeed, been already shown in a number of instances that actual nephritis may be set up by exposure to the *x*-rays. Hence, unquestionably, a pre-existing nephritis may readily be made worse by *x*-ray exposures.

If we are correct in all the statements that we have just made, it would appear highly inadvisable, unless urgent reasons to the contrary exist, to use *x*-rays in cases that are already the subjects of a noteworthy degree of general intoxication that is produced by either infectious disease or metabolic disorder. Whether all our observations are correct or not, it would appear that there is at any rate some danger in adding to such an intoxication the sudden necessity for metabolizing and excreting a large amount of the products of tissue breakdown. It has already become evident that cases of nephritis should be exposed to the *x*-rays only with great caution, and our observations emphasize this point still farther.

HYPERTROPHY OF THE ISLANDS OF LANGERHANS IN DIABETES MELLITUS.

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Since the publications of Opie and Ssobolew much attention has been directed to the role of the islands of Langerhans in connection with carbohydrate metabolism and particularly to the changes which are found in them in cases of diabetes mellitus. These changes consist for the most part, as is well known, in degeneration and sclerosis, in which the strands of cells composing the islands are replaced by hyaline-pink staining material. From the frequency of this change and its isolated occurrence in certain cases of diabetes the idea arose that the islands constitute an organ whose duty it is to maintain in some way the ordinary course of carbohydrate metabolism and whose destruction gives rise to such disturbances of this metabolism as are seen in diabetes when sugar is excreted in the urine. Certain observers, however, among whom Hansemann is prominent, think that lesions of the islands are of little importance in the causation of diabetes, and lay more stress upon changes occurring in the pancreatic tissue in general, and Hansemann claims for a type of granular atrophy of the pancreas, which he has described, the chief place in the pathological anatomy of the disease.

There are, however, as Sauerbeck points out in his review of the literature, many cases in which no such definite lesions of the pancreas are to be found and in which the cause of the diabetes must be regarded as extrapancreatic.

Various attempts have been made to give some definite outline to a theory of diabetes without as yet, it is true, arriving at any very lucid working hypothesis. Even if the islands of Langerhans are quite essential to the furtherance of carbohydrate metabolism, as the upholders of that theory believe them to be, we are still at a loss to know the nature of their activities and just where in the chain of events which constitute carbohydrate metabolism their influence is felt. It seemed for a time that with Cohnheim's experiments upon the effect of the interaction of muscle extract and pancreatic extract upon carbohydrates some light had appeared, but more recent work seems to have invalidated to a great extent these results, tempting as they were.

It was with these facts in view that the present case aroused interest, inasmuch as it shows alterations in the islands of Langerhans in the course of diabetes, but alterations which can hardly be interpreted as degenerative changes, nor, indeed, as changes which might bring about their functional insufficiency; on the other hand, they are changes which seem to indicate an actual increase

in the bulk and functional capabilities of these islands. The case is as follows:

L. H., a boy, aged ten years, was brought to the Johns Hopkins Hospital on December 14, 1905, complaining of headache, frequent micturition, and extreme thirst. His family and personal history were unimportant. The condition of which he complained had begun three weeks previously with very intense headache. His appetite was not excessive. On entry it was found that he was a somewhat emaciated boy, but physical examination was practically negative. The blood showed approximately normal conditions, except that a little fat was observed in the centrifugalized specimen.

On entry the urine was found to contain 6.6 per cent. of dextrorotatory sugar as estimated by the aid of the polariscope. On December 30, this had decreased to 5.3 per cent. (by Pavy's titration method 5.1 per cent.). Later the amount decreased gradually, being 2.5 per cent. on January 5, and 3.2 per cent. on January 11. No β-oxybutyric acid was present, but acetone and diacetic acid were found in all the more recent examinations.

On February 4 he began to be drowsy and very dull, but physical examination was then quite negative. On February 5 he was still very dull and was given intravenous injections of sodium carbonate. The stupor was such that it was unnecessary to use a local anesthetic in exposing the vein. Very deep respirations with pallor and cyanosis were present at this time. On February 6 air-hunger continued, and, although the patient became brighter after the sodium injection, he lapsed again into coma which did not yield to further injections of alkali. During the injection he suddenly vomited a quantity of fluid, some of which was aspirated into the lungs, with immediate death.

At the autopsy, which was performed a few hours after death, the body was found to be that of an emaciated boy, with dry scaly skin. Examination of the internal organs failed to reveal any gross change whatever, except the presence of food materials in the bronchi. No examination of the central nervous system was permitted.

The pancreas weighed 35 grams. It was normal in color and consistence; on section the ducts appeared normal, and the lobulation and general character of the cut surface could not be said to present any abnormalities.

Microscopically, too, it may be stated briefly, careful examination of the organs, other than the pancreas, failed to reveal any histological abnormality, except for the presence in the liver and renal epithelium of vacuoles containing glycogen.

Chemical examination of portions of the pancreas, which were submitted to Dr. Amberg, showed that the fermentative activities of extracts of the gland were those of a normal gland.

For the rest, portions of the gland were taken from the head, the

middle portion, and the tail, and examined in serial section after fixation in Zenker's fluid or in alcohol.

It was found that, in a general way, the pancreas is not much altered, there being no great destruction of parenchyma nor any overgrowth of connective tissue; the lobulation is practically normal, and, for the most part, the acini which make up the lobules cannot be distinguished by any alteration from the normal. The islands of Langerhans, however, which are far more numerous toward the tail than in other portions of the pancreas, are very conspicuous, and seem larger and much more deeply stained than normal. So striking is their appearance that they seem to stand out very prominently throughout the section. Each lobule has such an island in its central portion, and frequently the islands are more numerous and seem to lie close together or even to be almost continuous with one another. Probably these are points in which the somewhat eccentric islands of adjacent lobules approach one another. In size they vary greatly, as seen in serial sections, where the equatorial section may be found, as well as in single sections, where, of course, the smaller areas may always represent merely tangential sections of an island. On the average they are apparently distinctly larger than the normal islands, a basis for which statement may be found in the following table of comparative measurements in which islands were measured in five normal glands:

Autopsy.	No. of islands measured.	Average size.
2685	9	0.132 x 0.156
2662	8	0.104 x 0.100
2679	10	0.200 x 0.168
2693	7	0.172 x 0.128
2698	8	0.180 x 0.180
		average 0.157 x 0.146
2670 (diabetes)	22	0.240 x 0.188

In their histological structure, these islands are quite different from the normal in several respects (Fig. 1). They are far less sharply outlined, having indeed nowhere such a clear contour formed by a membrane or a layer of connective tissue as may often, if not always, seem to encircle the normal island. Instead of this the strands of cells which compose them are almost everywhere distinctly continuous with the cells of the adjacent acini. The transition is perfectly definite and by no means difficult to find or observe (Fig. 2). As one passes from the secreting cells into those of the island, however, a very marked qualitative alteration is observed, as well as the conspicuous change in their arrangement. The cells in the island are quite different in form from those of the acini, being elongated with square ends; they are arranged in long, tortuous, and anastomosing columns, which twist into a sort of knot,

and are kept apart by spaces in which lie bloodvessels. Usually only a single row of cells forms these strands, their long axis being

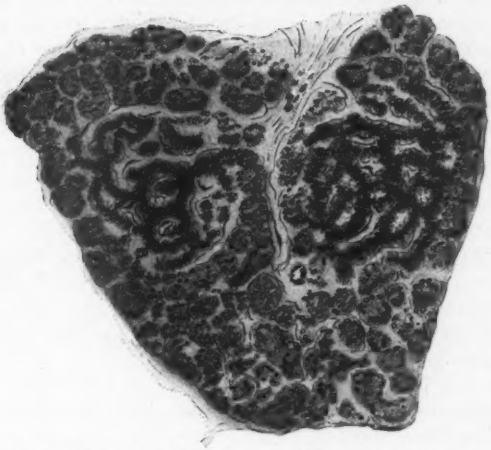

FIG. 1.—Islands of Langerhans of the hypertrophied type, continuous with and probably differentiated from the adjacent parenchyma.

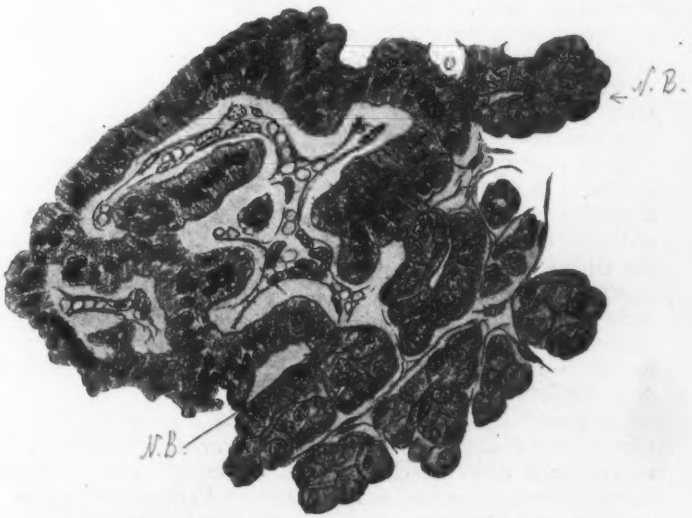

FIG. 2.—Margin of one of the enlarged islands more highly magnified, showing the continuity of the cells of the island with those of the adjacent acini.

arranged transversely to the strand, and their nuclei lying in the middle, so that the whole forms a band of cells with a central row

of nuclei. The protoplasm of these cells is less granular than that of the parenchyma in general. The nuclei are large and vesicular and contain coarse chromatin particles, which stain deeply. A large, deeply-stained nucleolus is especially conspicuous, and renders it easy to distinguish these cells from those of the acini.

Such islands, therefore, do not resemble with any precision the normal island of Langerhans. They are not sharply outlined; their columns of cells are long and tortuous and independent, being seldom more than one layer of cells wide; they are everywhere directly continuous at their ends with the adjacent parenchyma; and they stand out prominently by reason of the abundant chromatin content and conspicuous nucleoli of their nuclei.

In many places such strands of cells are intercalated in an isolated way in the general parenchyma, where they are easily recognized; but it is probable, if not certain, that these are always outposts of an island approached tangentially by the knife. They are not found in any connection with the ducts, but lie, as a rule, toward the centre of the lobule. From this mode of occurrence and their general appearance there seems little doubt that they represent the islands of Langerhans.

With few exceptions all the structures found throughout the pancreas, which could be regarded as islands, have these characters. It must be stated, of course, that toward the head of the pancreas there seem to be many lobules without any such bodies. There are also in that part of the pancreas, lobules, in the central portion of which there are no well-defined islands, but in which the parenchyma gives place throughout a relatively small area to a compactly arranged mass of cells, exactly like those forming the islands, but no longer arranged in single rows. In places these cells, less regular and columnar in form than in the above-mentioned islands, are closely applied to one another in such a way that they form irregular radiating masses in which any capillaries present are separated by the thickness of several rows of cells. Such masses resemble only faintly the normal islands of Langerhans. They have neither their arrangement nor their characteristic cells, but are simply radiate masses directly continuous with the adjacent acinar cells, or cells distinguishable by the character of their protoplasm and their deeply stained nuclei.

But there are other lobules which have a quite different look. Chiefly in the tail of the pancreas there are large lobules, few in number and collected closely together, in which the islands of Langerhans are much more like the normal and do not exceed the normal in size. These are sharply and smoothly outlined by a thread of fibrous tissue (Figs. 3 and 4), which separates them clearly from the surrounding acini, at least at most points. In their structure and in the appearance of these cells, on closer inspection, however, they too are very different from the normal; they are made up of

rather large columns of cells separated from one another, not by spaces, but merely by the capillaries to whose walls they are closely

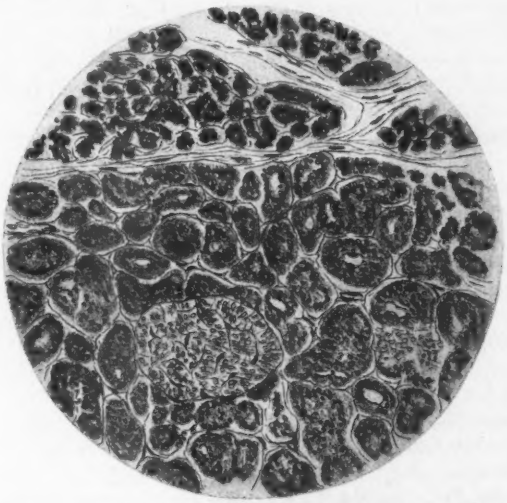

FIG. 3.—Portion of an enlarged lobule, showing enlarged acini and an island of Langerhans more closely approaching the normal. In the adjacent lobule the parenchyma is normal.

FIG. 4.—Margin of the island shown in Fig. 3. The adjacent acini of the parenchyma are larger than normal. The drawing shows the character of the cells of the island with the peculiar small bodies at the nuclear pole.

applied. Were it not for the great transparency of the cells themselves, such islands would appear very compact, but the cells seem to consist of only the merest ragged outline of protoplasm. The nuclei stain rather palely and do not present so distinct a nucleolus as in the cells of the other islands. They are often accompanied by peculiar small, rounded, bodies which lie near their poles and which take a faint nuclear stain. The nature of these small bodies is not clear.

The acinar tissue which makes up the lobules in which this type of island lies, is different from that in the other lobules, in that the acini and their component cells are much larger. This may be seen in Figs. 3 and 4; but it is much more striking when one can compare under a low power the appearance of such lobules with that of the adjacent ones. That there is an actual increase in the bulk of the tissue seems evident from the fact that sometimes not all of the tissue of the lobule has undergone this enlargement, but only portions of it which then stand out as overgrown masses which push aside and flatten out into concentric rings the adjacent small acini.

Otherwise, however, I can discern no especial change in the character of the cells and no mitotic figures were found.

Another case of a similar character, to which my attention was called by Dr. Opie, occurred also at this Hospital. It was as follows: A child was admitted to the hospital complaining of hunger and thirst, frequent micturition, and excessive loss in weight. The intense symptoms developed suddenly three weeks before entrance. On admission the child was found much emaciated; the skin extremely dry and harsh. Physical examination was negative. The child was semiconscious, and the respiration was labored. The urine contained 2 per cent. of sugar. Acetone was present, as shown by Le Noble's test. There was also a trace of albumin. The patient died in coma, two days after admission.

The anatomical diagnosis reads as follows: Diabetes mellitus; subserous hemorrhages; hemorrhagic gastroenteritis with ulceration; hemorrhage into the intestine; extreme fatty degeneration of the organs. The organs were practically normal throughout, except for the ulcerative condition of the mucosa of the intestine and for the pallor and accumulations of fat in the kidneys and liver. The blood showed a little free fat. The central nervous system was not examined. The pancreas weighed 25 grams, was soft, and perhaps more opaque looking than normal.

In this case the pancreas presents an appearance almost precisely similar to that described above. Only two sections are at my disposal, but from these it appears that there is not only a change in the islands resembling that first mentioned, but also an increase in the bulk of the secreting tissue in certain lobules. The islands, however, in this case, are fairly sharply outlined as in the normal

and are all of one kind. The swollen parenchyma shows very distinctly a basal layer of darkly stained granular protoplasm, as contrasted with the paler more central part.

On the whole, therefore, we have in these cases of diabetes in children a peculiar condition of the pancreas, in which the islands of Langerhans are apparently increased in size and number, and modified in their general appearance, and in which certain portions of the parenchyma are also increased in bulk. It remains for us to explain the relation of these changes to the diabetes.

This is a difficult problem in view of our ignorance of the nature of diabetes; but even a working hypothesis may be of some value, and it has occurred to me that there is here the result of some disturbance in carbohydrate metabolism from extrapancreatic causes such as impose an excessive amount of work upon the islands of Langerhans, and that these in order that they may maintain their control of their own particular link in the process have undergone the compensatory hypertrophy which has been described. That this explanation of hypertrophy in an organ of internal secretion is not entirely fanciful is shown by the condition of the parathyroids in a case of gastric tetany, in an old man, in which the parathyroids were greatly hypertrophied in the attempt to maintain their function of neutralizing poisons produced in the stomach.[1] In that case, however, the accumulation of poisonous materials in the highly dilated stomach was such that despite the great size of the parathyroids the man died of tetany. So here in spite of the great increase in the bulk of tissue of the islands of Langerhans the children died of diabetes.

It is also possible, and perhaps even probable, that these islands of Langerhans are not only hypertrophied, but indeed actually newly formed from the tissue of the pancreas. It may be that they have appeared in the tissue of the child's pancreas by a differentiation of Langerhans tissue from the ordinary parenchyma which might not be possible at a more advanced age. This view is supported by the very intimate connection which amounts to actual continuity with the cells of the acini. In that case the presence of a few islands of Langerhans much more closely approaching the normal would suggest that they were the only remaining islands of those originally present, and that the others had been destroyed by some specific process, constituting in that case an intra-pancreatic cause of the diabetes. Thus, two rather distinct hypotheses are suggested: the first, that the excess of Langerhans tissue is the response to an extrapancreatic cause of diabetes, and the second that the destruction and disappearance of all but a few of the islands of Langerhans produced diabetes, but also subsequently a regeneration of

[1] MacCallum. Die Beziehung der Parathyroiddrüsen zu Tetanie. Centralbl. f. allg. Path., 1905, xvi, 385.

islands from the parenchyma. There are no remains or scars, it is true, in the position of the destroyed islands and those now in existence occupy their central position fairly accurately, but still the possibility of this mode of genesis of the condition cannot be ruled out; and, indeed, it might explain very well the increase in bulk of some of the secreting parenchyma which could result from the coincident destruction of similar tissue elsewhere in the pancreas. That the islands of Langerhans are now in a degenerated condition and incapable of function might perhaps be suggested as the cause of the diabetes from their altered appearance, but the idea can hardly be entertained, since their cells are not degenerated and have every appearance of functioning actively. Certainly, however, whatever the mechanism of its immediate production, there is an increased bulk of Langerhans tissue with a coincident diabetes, and whether the cause of the diabetes be intrapancreatic or extrapancreatic, it seems clear that the hypertrophy of the Langerhans tissue is compensatory in nature, as far as it goes, even though it were finally inadequate to avert death.

But little in the literature seems to bear directly on the point discussed here. M. B. Schmidt,[2] in describing extensively altered glands in diabetes, found island-like structures similar to those first described, and regarded them as the result of the differentiation of island tissue from the parenchyma. Gutmann,[3] in one case of pernicious anemia and in one case of diabetes, found somewhat similar newly formed islands, which he also regards as being developed from the parenchyma by a process of differentiation. For this process he finds, however, no adequate explanation, since there seems to be no destruction of the pancreas sufficient to call forth such a response.

UNIVERSAL ITCHING WITHOUT SKIN LESION; HEMATOGENOUS UROBILINURIA; MALARIAL POISONING; PECULIAR ERYTHROCYTOLYSIS.

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AND

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The case here detailed is believed to be not only unusual but to present a condition not hitherto described, so far as the relation of the cause and its effects are concerned. The innumerable possi-

[2] Münch. med. Woch., 1901, No. 41.
[3] Virchow's Archiv, vol. clxxvii, Supplementheft.

bilities of diagnosis were gradually reduced as the study of the symptoms and excretory changes proceeded, until it seems to us certain that but one theory can be held about the origin of the blood disorder and its accompanying manifestations.

While the high eosinophile count which was one of the peculiar features of the case remains unaccounted for except as a part of a curious and unusual blood condition, we believe that all the hemic and urinary changes, as well as the distressing symptoms of Raynaud's disease and of the persistent itching, are accounted for by the destructive erythrocytolysis set up by twenty-five years of chronic malarial poisoning. Although direct evidence of this malarial poisoning cannot at present be found, we consider it sufficiently proved not only from the blood and other signs, but by the exclusion of other possible causes.

The patient, M. H., aged fifty years, was born in Pennsylvania of German-Hebrew parentage. The family history is good; his father died at seventy-two of "heart failure;" his mother is living, aged eighty-five; a brother and four sisters are alive; the only doubtful point is that a sister is said to have died of "anemia" at twenty-three years old. She had been ill for four or five years with some nervous disturbance following typhoid fever, but was married, became pregnant, miscarried at two months, it is said from "weakness," and died a few months later of a "decline," probably, but not certainly, phthisical. Mr. H. is married and has one healthy child. He has had no illnesses except the diseases of childhood, but has always been nervous and easily perturbed, with a tendency to depression. His weight is 135 pounds, usually 150 pounds; his height, 5 feet, 7 inches.

He has lived in California in various places from 1859 to the present, except from 1865–1870. From 1876 to 1902 he was in a region, Willows, described as "malarial." Many persons suffered there with obscure forms of illness, supposed malarial, though frank chills and fever were uncommon. During his residence in this district he had various discomforts and ailments like those of masked or undeclared malaria, such as leg-ache, head-ache, nape-ache, and biliousness, for seven or eight years. The fact that quinine relieved all the symptoms in him and in the other residents of the district makes it sufficiently certain that they were of malarial origin.

His habits have always been sedentary; there are no excesses, venereal, alcoholic or other, admitted. He smoked for many years largely, but never, so far as known, with deleterious results and not to an extravagant extent, six or seven light cigars daily.

A mild form of Raynaud's disease has been present for seven or eight years, beginning soon after the malarial infection described. His hands become mottled blue and white and swell greatly in cold weather, and are pink in warm weather. They perspire very little and are subjectively cold.

His present complaint is stated to have begun in 1902, or even a little earlier, with constant indigestion, severe epigastric distress, lasting five or six months. During this time he first suffered from the main symptom which has distressed him ever since, namely, an intolerable itching of the whole body. No lesion of the skin has ever been present, no discoloration, no jaundice, no hepatic colic. The itching grew better for a time when the digestive disturbance was treated by lavage, but recurred afterward worse than ever with no return of the digestive symptoms. In January, 1903, he broke down nervously, partly from the loss of sleep caused by the itching. He made some improvement, but relapsed, and in October, 1904, was ordered a sort of rest treatment, very incomplete in character. There was again some betterment, but the itching returned, his sleep became more broken, and a condition of considerable mental depression followed.

Various treatments, local and general, varying from applications of carbolic acid, menthol, and olive oil to warm baths, at various times brought some relief but no permanent change for the better.

When seen in April, 1905, Mr. H.'s general appearance was fairly good. His color was not deficient, and though his skin was not clear and had a slightly muddy look, there was no icterus. His complaint was of general nervousness, inability to apply himself to work, some depression, constant general itching, much worse at night, with broken sleep.

His station was slightly unsteady; knee-jerks, weak, small, reinforcible; pupils reacting normally; other reflexes normal; no pain or girdle sensation; bowels normal; lungs clear; heart rhythmic, doubtful mitral systolic murmur, second sound clear; compensation perfect. The patient was not aware of any cardiac trouble and had no symptoms of deficient cardiac function. Pulse tension (radial) good.

The blood and urine were examined with care on April 19, and as the diagnostic interest of the disease centres in the blood and urinary findings, these must be given in detail. Before the minute study of the urine could be made the peculiar port-wine hue which it assumed on standing attracted attention and suggested a search for various coloring materials, melanin, melanogen, phenol, bilirubin, urobilin, blood, and bile acids. Numerous tests for all these proved negative except for urobilin, which was positively demonstrated as present by several chemical methods, and most definitely by its peculiar spectroscopic absorption band. We consider that this urobilin was not derived through bilirubin, but directly from hemoglobin, for the following reasons:

(*a*) No bile acids or bile pigments were present at any time.

(*b*) The liver functions were unimpaired so far as the nitrogenous output was concerned.

(*c*) There was no jaundice.

(*d*) Urobilinuria if hepatic in origin is almost always accompanied by an increase of indican, which in this case was never found in a quantity beyond a faint trace, certainly not more than would normally be present.

(*e*) Raynaud's disease was present and with it an hemolysis which although not altogether of the kind often found with Raynaud's might be related to it and be a source of the urobilin.

(*f*) A constant relation was found to exist in our later observations between the degree of hemolysis and the urobilin content, the one increasing or diminishing with the other's changes.[1]

The quantitative urinalysis made on the same date as the study described above was as follows: Twenty-four hours' amount 1240 c.c.; acid reaction; specific gravity, 1021; urea, 26.66; albumin, a trace; sugar, absent; chlorides (*as* NaCl), 8.99; uric acid, 0.804.

Microscopic examination, showed many polymorphonuclear leukocytes, a moderate amount of squamous epithelium, which was distinctly stained yellow, and a few hyaline and pale granular casts.

All the evidence, both positive and negative from the urine analysis, seemed thus in favor of the derivation of the urobilin from the blood rather than from the liver. This view was strengthened by the blood examination, which was as follows: Hemoglobin, 58 per cent.; leukocytes, 19,000; lymphocytes, 35 per cent; large mononuclears, 4 per cent.; transitionals, 4 per cent.; polymorphonuclears, 42 per cent.; eosinophiles, 13 per cent.

There was a very pronounced degeneration of the red blood cells, which showed a number of forms within the erythrocytes. These appeared as non-staining, slightly granular bodies, usually eccentrically located. Sometimes they seemed to be half within and half without the corpuscles and sometimes altogether without and deeply indenting the sides of the erythrocytes against which they lay. Though not very numerous they were well distributed in the slides

[1] In testing for bilirubin the following methods were used: Smith's (W. G. Smith, Dublin Med. Jour., 1876, p. 449), Huppert's (Arch. d. Heilk., 1867, vol. viii, pp. 351 and 476), Gmelin-Rosenbach (Centralbl. f. d. med. Wiss., 1876, vol. xiv, p. 5), Gmelin (Die Verdawung nach Versuchn, Heidelberg, 1826, i, p. 80). In the search for biliary acids the urine was treated as Tyson suggests (Phila. Med. Times, July, 1873): 250 c.c. was evaporated slowly to dryness over a water-bath. The residue well mixed in a glass mortar with an excess of absolute alcohol, filtered and the filtrate treated with from twelve to twenty-four times its volume of ether. In this manner the bile acids, if present, are precipitated. Filter and dissolve the residue in distilled water. Decolorize by passing through animal charcoal. The resulting clear and colorless liquid is subject to Pettenkofer's test.

When the amyl-alcohol extract of the urine was treated with a concentrated alcoholic ammoniacal solution of zinc chloride the resulting mixture showed a strong green fluorescence and further spectroscopic examination gave a marked absorption band of urobilin Indeed, it was found that the urine itself without any treatment gave this band. No effort was made to determine the urobilin quantitatively, as the only practical method is that of Hoppe-Seyler (Virchow's Archiv, 124), and this we consider inaccurate in view of the fact that some urobilin may always be lost in the washing of the chloroform extract, no matter how slightly this be done. The Hoppe-Seyler method was used to isolate the body in its pure state.

and in repeated examinations were always present. Efforts to stain them wholly failed.

The extraordinary eosinophile count, nearly 10 per cent. above the normal, which this examination disclosed, continued high during the whole course of our observation of the case, though later it fell somewhat.

In wet preparations the cells exhibited an excessive tendency to rouleaux formation.

The general type of this degenerative relation was like Maragliano's endoglobular change, as was agreed by Professors Allen Smith and Alfred Stengel and Dr. John C. Da Costa, Jr., all of whom examined with interest many slides of the patient's blood at various times.

No other changes than these were found in the blood in the many examinations made afterward and these persisted in various degrees during the ten months of observation. Special pains were taken to search repeatedly for any form of Plasmodium malariæ, but none was ever found. Repeated attempts were made with various stains upon the granular bodies. With Wright's stain the extruded granular mass took on a deep blue, but they would not color at all with eosinate of methylene blue or with hematoxylin-eosin.

The number of white cells (19,000), the high proportion of eosinophile corpuscles and the presence of transitional forms suggested leukemic conditions, but no general symptoms were present that would point to such a conclusion, and besides the total number of leukocytes diminished very rapidly after treatment was begun (April, 19,000; June, 13,250; October, 5540), although there was no alteration in the eosinophile percentage for some time.

Ehrlich's original statement in describing the affinity of leukocytes for eosin was that this affinity existed only in leukemia, but further observations have shown that this is not true and that eosinophile corpuscles are found in a bewildering variety of diseased states. The possibility of intestinal parasitic infection, a condition which might produce some of the signs and symptoms present, was considered, and careful and often repeated microscopic examinations of the stools after sedimentation were made without discovering any ova or other evidence of the presence of parasites.

Finally, after discussing many theories to account for the eosinophilia and making search without success for any case resembling this one, we put aside the question of the origin of the high percentage of eosinophile corpuscles, believing this to be rather a blood condition related to the general hemic changes than one of special diagnostic significance in the present instance.

The question of treatment had thus to be settled without any very precise basis of diagnosis to rest upon or, at least, without being founded upon any named known and defined disease,

Symptomatically, we had to deal with the slight renal irritation

shown by the presence of a few casts and a trace of albumin, with the moderate general anemia, shown by the considerable deficiency in hemoglobin, the large leukocyte count, and, more significantly, by the erythrocytolysis which was present in so marked and peculiar a form. From the patient's point of view the symptoms of general nervousness, insomnia, depression, and above all the nearly constant and very distressing itching to which the insomnia and nervousness seemed largely due—were the important matters. That the itching was caused by the urobilin seemed a reasonable conclusion and that the urobilin had its origin in the breaking down of the red cells appeared equally certain. The pedigree of urobilin, as was said above, is uncertain, that is, it may be derived from either bile pigments or blood pigments. In the present case the bile pigments could be excluded, leaving only the hemic origin probable. Finally, there were the Raynaud symptoms, also thought to be due to the blood disturbance, but more fully to be discussed later.

If, therefore, the blood condition could be improved and the erythrocyte destruction stopped the most annoying symptom would be removed.

Attacking the disorder from this point of view, the patient was ordered tincture of the chloride of iron to be taken in increasing doses for its double effect as a hemic tonic and on kidney irritation, an alkaline laxative (sulphate of magnesium), daily massage, and warm baths containing carbonate of sodium one night and starch solution the next. For the first few nights, $\frac{1}{400}$ grain of atropine sulphate seemed to relieve the itching but soon lost its effect. Mr. H. had had every variety of local application that could be imagined for pruritus, without effect—so no such drugs as menthol, carbolic acid, and the like were tried. After a week or two, small doses of Fowler's solution were ordered and given for about three weeks out of four during the whole of the treatment.

The improvement was marked in the first few weeks, the itching and consequent sleeplessness and nervousness grew less constant and less severe.

In June after about five weeks' treatment the blood count was as follows: Hemoglobin, 72 per cent. (April, 58 per cent.); white cells, 13,000 (April, 19,000); red cells, 5,450,000.

The last week in June, with a small increase in hemoglobin (74 per cent.), other blood conditions remained about the same, the differential count showing the same eosinophile percentage (13), and the same high general proportion of leukocytes. The degenerative changes, however, under the microscope were much less both in extent and in severity. The spectroscopic absorption band of urobilin in the urine was present, but proportionately less marked and the patient was much more comfortable, having very little itching by day and much less than formerly at night.

During the summer a course of alterative medication seemed to do

a great deal of good, all the symptoms steadily, though slowly, lessening under a combination of iodide of potassium, bichloride of mercury, and Fowler's solution. Albumin entirely disappeared from the urine and with it the casts went.

Without going needlessly into detail it may be said that the patient continued to progress satisfactorily under the above *regime*, and in November was able to say that he had not in years been so free from itching.

In October, examination of the urine showed it to be practically unchanged, except that there was only a trace of albumin, no casts could be found, and the spectroscopic band of urobilin was fainter than in the summer.

In November no albumin could be demonstrated by any test.

Blood Examination, November 23, 1905. Erythrocytes, 4,607,000; leukocytes, 9111 (April 19,000); hemoglobin, 76 per cent. (April, 58 per cent.); color index, 0.82.

Differential Leukocyte Count. Lymphocytes, 20 per cent.; (April, 35 per cent.); transitional and large mononuclear leukocytes, 17 per cent. (April, 8 per cent.); polymorphonuclear leukocytes, 49 per cent. (April, 42 per cent.); eosinophiles, 13 per cent. (April, 13 per cent.); basophiles, 1 per cent.

There was again marked improvement since the examinations in July and October in the degenerated erythrocytes. At this time sweat baths, followed by a warm, gentle douche, were ordered in place of the alkaline and starch baths. The patient continued to improve until he was discharged and sent home in February, 1906.

The last blood examination made before Mr. H. left Philadelphia showed practically normal red and white count, with a color index of 0.94. The differential count of the leukocytes was only remarkable for a continued excess of eosinophile corpuscles, which had, however, diminished to 6.3 per cent., the normal figure being from 3 to 4 per cent. In the stained specimens very few cells could be found showing the endoglobular change which formerly was present in every field. A very faint spectroscopic absorption band of urobilin was still observable on testing the urine.

We hear since this gentleman underwent the nervous shock, exposure, and physical strain of the San Francisco earthquake that some of his symptoms have reappeared, but we have not received any details that could be added to this interesting case-history, except that he had neglected for some time before the earthquake to follow the line of treatment which he had been ordered to continue, so that this may have had something to do with the partial relapse.

The interest of the case lies in what appears to us a new symptom-complex and in the probable malarial origin of the disorders. It is the combination of these symptoms that is the important feature, for none of them are in themselves extraordinary, except the intense persistent general itching. This latter was, like the itching of

icterus, universal, but far more severe and annoying than that of jaundice. The peculiar blood changes, although superficially resembling these of malaria, differed in presenting but one form of alteration in the corpuscles and this form resistant to the stains which have affinity for the plasmodia. Nevertheless, we consider this degeneration due to the malarial poisoning and productive of the urobilin in the circulation to which in turn the itching is due. The evidence for chronic malarial infection seems to us sufficient. First, a residence in a known malarial district, together with frequent attacks during that residence with such symptoms as are produced by masked or undeclared malarial infection; second, the therapeutic test of these symptoms, which both in the patient and in other persons with like troubles were relieved by quinine; and third, the presence of Raynaud's complex. In Raynaud's first description of the combination of symptoms since called by his name (1862) the previous occurrence of malarial fever was noted in some cases and again in the second publication (1874). Other observers have found it so frequently precedent that they have considered an almost necessary relation to exist. Petit and Verneuil,[3] for example, cite over twenty cases of Raynaud's disease occurring in subjects who have had, "even some years before, attacks of intermittent fever, more or less severe, and more or less rebellious to treatment. It is in cases of this type that the etiological relation can be and indeed has been most readily recognized." Other authors have noted the same connection, and some have described in not very definite fashion peculiar blood changes, hemoglobinemia, abnormal tendency to rouleaux formation, stained liquor sanguinis. Apart from these a peculiar granular degeneration in the red blood cells has been frequently found in Raynaud's disease, but it is not like that noted in our case.

As a matter of interest, but not with any special relation to the present discussion, as the existence of the Raynaud's disease requires no confirmation, it may be added that local circulatory symptoms such as began after the malarial troubles are peculiarly common in Hebrews. It may be that this is only another instance of the already well-known fact that nervous disorders occur in that race with especial frequency. The patient is of sound German-Jewish stock, not of the Polish or Russian families that fill our clinics with hysterical and neurasthenic cases. Dr. S. Solis Cohen, of Philadelphia, says that during a year in which he was on the lookout for instances of "circulatory ataxia" he saw in his clinic incidentally about sixty cases of Raynaud's disease, all in Jewish patients who had come under treatment for other disorders.

Finally, the points for emphasis and interest in the case may be thus resumed: persistent universal itching without skin lesion,

[3] Rev. de Chir., 1883.

due to the presence of urobilin in the circulation, which in its turn was the result of a peculiar hemolysis, caused by chronic malarial poisoning; Raynaud's disease, probably of the same malarial origin; slight renal irritation; and general nervousness. The therapeutic and diagnostic interests lie in the failure of local measures to relieve the itching, the mistaken views of the origin of this chief symptom as the result instead of as the cause of the neurasthenic state, the supposition that it had a digestive origin, and the final partial success of treatment directed to the improvement of the blood-making functions, together with such alterative measures as sweat baths and stimulating douches, and the moderate long-continued administration of iodides, mercury, and arsenic.

FIBROID TUMORS OF THE VULVA.

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Benign tumors arising from the external genitalia in women are of infrequent occurrence. The number of reported cases is comparatively insignificant, and if the growths reported be restricted to fibromas, the number is surprisingly small. Thus, Burr,[1] in 5000 gynecological cases, tabulated at the Michigan University Hospital, did not find a case of vulvar fibroma. Williams in studying 420 cases of neoplasms of the external genitalia found but seventeen fibromas, or about one in 600 of all the new-growths arising from the female genitalia that he studied.

The reason for this infrequency is difficult to find. The histology of the labia and of the other tissues about the vaginal outlet would seem rather to predispose this region to stromatogenous new-growths.

Loose connective tissue, with abundant vascular supply, and the presence of many mesoblastic elements with much muscular fiber, should be a fertile soil for the production of such growths. If there be added the irritation from clothing and bodily exercise, and the constant risk of a certain amount of trauma, especially in married women, this predisposition would seem to be still more marked.

The life-history of the labial tissue, as Burr says, is in no sense different from that of similar tissues in other parts of the body. The same phenomena of development, maturity, and atrophy exist here as elsewhere, and the same etiological factors should be in

[1] A Case of Fibroma of the Vulva, New York Med. Jour., 1905, lxxxi, 340.

operation here as in other localities where fibromas are more commonly found.

The number of fibromas is further reduced by the fact that many of the older cases were in reality elephantiasis vulvæ, as is pointed out by Veit.[2]

The old view held and strongly advocated by Scanzoni[3] that these growths are due to the organization of unabsorbed blood clot in the labia is unsupported.

Fibroid tumors of the vulva occur usually in parous women, and toward the end of the period of sexual maturity. In Burr's statistics two cases occurred between the ages of thirty and fifty years, three cases between the ages of twenty and thirty years, and one under twenty years. In the 34 cases collected by myself the age limits were as follows: Under twenty years, 3 cases; twenty to thirty years, 5 cases; thirty to forty years, 7 cases; forty to fifty years, 10 cases; and over fifty years, 3 cases. In 6 cases no age was given.

The great majority of the patients were married and had borne children. Of the 18 cases studied by Burr, only 1 was in an unmarried nulliparous woman. Of the cases that I have studied, 12 were in parous and 5 in nulliparous subjects. They are more common in negroes than in white persons. Ramsey says 12 in negroes, to 3 in white women.

The growths vary greatly in morphology. They are mostly small, ranging from walnut to orange size, but they may reach large proportions. Largeau[4] removed a cystic fibromyoma from the left labium majus that weighed 75 pounds, while Whitney[5] reported a case in which a tumor, having probably the same histogenesis as those under discussion, was found to weigh 268 pounds. The vast majority, however, are small.

The location of the growths is variable. A majority seem to spring from the labia majora, with the preference for the left side. The remainder spring, with almost equal frequency, from the labia minora and the tissues immediately adjacent to the clitoris. In Burr's cases, six grew from the right labium majus, eight from the left, while but one grew from the left and the right labium minus respectively. In 16 cases of my own statistics the tumor grew from the right labium majus, in 17 from the left, and in 1 from both.

The tumors may be pedunculated or sessile. In all probability all are sessile during their early development, becoming pedunculated as they increase in weight and as the constant pull of the tumor

[2] Handbuch der Gynecologie, Band iii, 216.
[3] Lehrbuch der Krankheiten der Weiblichen Sexualorgane, p. 582.
[4] Archiv. prov. de chir., 1892, i, 531.
[5] Subperitoneal Pelvic Fibromata, Annals of Surgery, 1905, xli, 823.

mass tends to stretch and attenuate the loose connective tissue in which they are embedded. Nine of Burr's and twenty-one of my own cases were pedunculated. The pedicle should be carefully studied, as it may determine absolutely the point of origin of the tumor. In Largeau's case the pedicle of the tumor ran far back into the pelvis, through the inguinal canal, and apparently to the uterus, although the operator did not care to follow it so far.

The duration and rate of growth of the labial fibromas vary greatly. They usually grow slowly, but may have periods of great activity, especially during pregnancy, and to a less extent at the menstrual period. Scanzoni calls attention to the fact that in several cases observed by him the tumor became very much congested and increased appreciably in size during the catamenia. Penrose[6] also reports a case in which a large pear-shaped, œdematous fibroid, growing from the right labium majus, increased to double its size at the menstrual epoch.

In appearance, then, the growths are sessile or pedunculated masses, arising from the labial tissue. When pedunculated the pedicle is usually of moderate length (4 to 8 cm.), but many cases are recorded in which the tumor hung between the thighs, being dependent from a long tenuous pedicle. The sessile variety may simulate closely cysts of Bartholin's glands, or even labial hernia. This is especially marked when the tumor has undergone cystic or myxomatous degeneration. The skin is usually roughened and corrugated, but rarely adherent. By reason of pressure upon neighboring skin surfaces, superficial ulceration is frequent; this, however, never becomes marked, though epithelioma may supervene.

The symptoms of these tumors are usually those resulting from the mere presence of a mass in so unfavorable a situation—a sense of weight from the tumor, discomfort in walking and sitting, with occasional sharp pain, should the tumor be struck or pressed upon. When the tumor tends to expand laterally, instead of becoming pedunculated, it may press upon and displace the urethra or meatus, or it may grow at the expense of the vagina, preventing coitos, or even becoming a bar to parturition (Zielcwicz[7]).

A curious case is reported by Kirchoff:[8] A girl, aged eighteen years, had for some time felt, when lifting any weight, as though something were trying to force itself out of the vagina. One day while lifting a kettle she experienced a sudden sharp pain, with some hemorrhage from the vagina. Upon examination, a pedunculated fibroid was found, arising from the inner side of the right labium majus, and reaching to the middle of the thigh, while the

[6] Amer. Jour. Obstet., 1896, xxxiv, 72.
[7] Archiv. f. klin. Chir., 1889, xxxviii, 340.
[8] Cent. f. Gyn. 1893, xvii, 1037.

hymen showed that it had recently been torn by the extrusion of the tumor from the vagina.

The diagnosis of these growths is ordinarily not difficult. The presence of a slowly growing sessile or pedunculated tumor in the labium, with the consistency of a fibroid, no skin adhesions, and no evidence of cachexia, should make the diagnosis plain. Hernia into the labium majus, whether intestinal or ovarian, may be a source of error. Tuttle[9] describes a case in which incision into the labium for fibroid revealed a structure resembling a hernial sac. Only after careful examination was it found to be a cystic fibroma, having its origin in the tissue of the round ligament. Fromme[10] also reports a case in which the differential diagnosis between labial hernia, cyst of Bartholin's gland, and solid tumor was uncertain. The growth proved to be a myoxmatous fibroma. The diagnosis in this case was confusing by reason of the patient being a virgin, of eighteen years.

A point of distinction has been made between benign and malignant growths of the vulva, with respect to their location. The benign growths are most frequently found arising from the labia majora, while the malignant neoplasms have their inception in the tissues about the clitoris or the labia minora.

The treatment should always be excision of the growth. The dangers of malignant degeneration are too real to permit of temporizing. Case after case is reported in which sarcomatous degeneration of a fibroid, with its attendant terrors, took place. The discomfort from the presence of the tumor and the comparatively trivial operation required for its extirpation usually render surgical interference a matter of course. The operation is usually simple, but severe hemorrhage may occur.

In Eichholz's[11] case a cavernous fibroid was removed, in which some of the vessels of the pedicle were 12 mm. in diameter. Storer[12] reports a case in which the pedicle was found to consist of a maze of veins and arteries, some of the latter of immense size, one fully as large as the femoral.

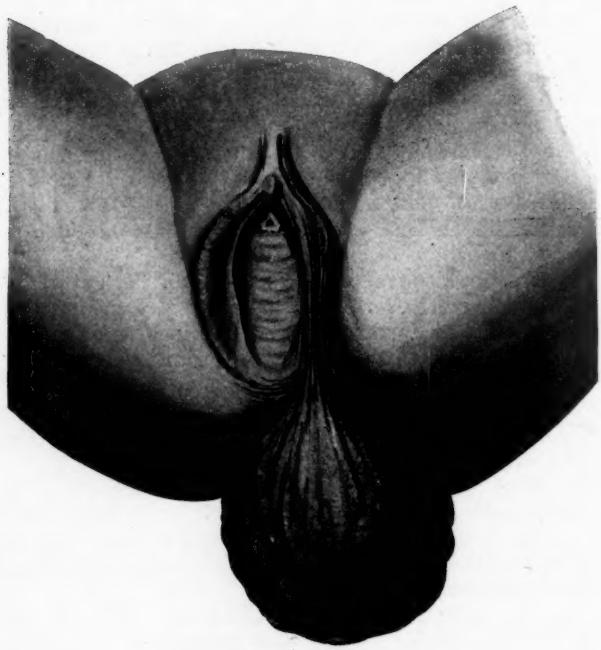
The case coming under my notice is as follows: M. S., American, married, forty-five years, VI-para, was admitted to the Gynecean Hospital October 31, 1905. She had always been a healthy woman, with no serious illness nor hereditary stigmata. There was no history and no evidence of any specific infection. Her marital life had been without incident.

Physical examination revealed no organic disease, Eight years before admission she noticed a small hard lump in the left labium

[9] Amer. Jour. Obst., 1891, xxiv, 114.
[10] Monatsch. f. Geb. u. Gyn., 1904, xx, 961.
[11] Frauenarst, 1892, vii, 520.
[12] Gynecological Journal, 1871, ix, 326.

majus. This increased in size steadily but slowly, until, at the time of examination, it hung as a mass, the size and shape of a pear, swinging between the thighs, and attached to the much thinned-out left labium majus by a pedicle, about 2 cm. in diameter and 10 cm. in length (see figure). Upon the inner surface of the tumor there was a circular, sharply defined, sloughing ulcer, 15 mm. in diameter.

Under ether anesthesia the tumor was extirpated without difficulty. The hemorrhage was slight and easily controlled. The



Myxomatous fibroma of the labium majus.

wound was closed by buried and superficial catgut sutures. The convalescence was uneventful.

The specimen consists of a tumor dependent from a pedicle 10 cm. in length, which had spread out the left labium majus. The growth measures about 6 cm. in diameter, is semi-fluctuating, entirely covered by skin. Where it came in contact with the skin of the thighs there is a punched-out ulcer, 15 mm. in diameter. The ulcer is shallow and its base is occupied by a grayish slough.

Microscopically, the neoplasm is a fibroma undergoing myxomatous degeneration. The entire picture is hazy; the nuclei of the cells stain slightly and show characteristic irregular prolongations. No granules of precipitated mucin can be discovered.

The chief interest in fibromas of the labia centers about their histogenesis. The simplest explanation is that they develop from the subcutaneous connective tissue, in the mesodermic tissues, so abundant in this region, or along the adventitia of the bloodvessels, as do most uterine fibroids. This manner of development has been strongly upheld by Klob[13] and others.

But it has undoubtedly been shown that many of these growths originate in much deeper structures. Fromme described a case in which there was found a fist-sized, fluctuating tumor, occupying the entire right side of the vulva, forcing the vaginal outlet to the left. The tumor was immediately under the skin. After removal the growth was found to be uniformly solid in texture, there being no cysts. Under the microscope the tumor was found to consist of a connective tissue capsule, enclosing the tumor itself, which was very rich in connective tissue, with a few muscle fibers. Throughout the entire growth there were noticed single, tubular glands, lined with a single layer of cylindrical epithelium. These glands gave evidence of being offshoots from Bartholin's gland. The writer concludes that the tumor must have sprung from the interstitial connective tissue in Bartholin's gland, and in evidence cites a case of von Recklinghausen in which there existed hypertrophy of the glandular connective tissue of Bartholin's gland. This establishes a second source of such neoplasms.

Kewisch[14] maintains that the tumors spring from the periosteum of the pelvic bones, or from the deep pelvic fascia, and supports the argument with illustrative cases. It may be, as Storer[15] has pointed out, that vulvar fibromas may arise from the connective tissues of the rectovaginal septum, and reach the labia by following lines of least resistance. Sanger[16] outlines another point of origin of labial tumors: the extraperitoneal portion of the round ligament, and he classifies these growths into four groups: (1) Intraperitoneal—the growth extending along the course of the round ligament from the uterine cornea to the internal inguinal ring. (2) Intracanilicular—the growth being entirely within the inguinal canal. (3) Extraperitoneal—the growth being in the abdominal wall, outside the inguinal canal, or in the labia majora. This group is subdivided into the tumors with pedicles and those which remain sessile. (4) Growths occurring in remote regions of the abdominal wall, but having a histological connection with the round ligament.

It is the third, or extraperitoneal group of tumors, which particu-

[13] Quoted by Fromme.
[14] Quoted by Fromme.
[15] Boston Med. and Surg. Jour., 1864, lxxi, 478.
[16] Archiv. f. Gyn., 1883, xxi, 279.

larly concerns us. A few typically illustrative cases of this type have been reported. Nebesky[17] describes such a tumor, of apple size, arising from the left labium majus, and of slow growth. Upon removal of the tumor, there was found a fibromuscular cord leading up into the inguinal canal, and corresponding minutely to the terminal fiber of the round ligament. In Hecker's[18] case there was removed from a sterile woman of forty years a tumor of the right labium majus, which upon examination proved to be a myoma of the right round ligament, associated with an ovarian hernia. Weber[19] cites a case in which there was found a fibrolymphangioma arising from the left round ligament, forcing its way down the greatly dilated inguinal canal, and finally becoming pedunculated, and hanging free between the legs. This occurred in a young virgin.

Many other instances might be cited in which the round ligament was clearly the seat of these tumors. In my own case there was no evidence of such formation, and the tumor is classified as one of the group springing from the subcutaneous connective tissue.

Fromme is authority for the statement that fibromyxomas and pure myxomas of the labia should never be considered as primary growths developing from mucous membranes, but always as secondary degeneration forms of fibromas or myxomas. Examination of my specimen showed it to be one of this class.

THE TREATMENT OF DIFFUSE SUPPURATIVE PERITONITIS.[1]

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In this communication I shall discuss only the operative and postoperative treatment, not the preventive treatment, of diffuse peritonitis. In regard to the degree of peritonitis in the cases to be reported, I may say that only those with a definite purulent exudate extending throughout at least the greater part of the peritoneal cavity, and accompanied with definite signs of diffuse, undefined peritoneal inflammation, have been considered. Cases with a moderate amount of seropurulent exudate in the vicinity of the causative inflammation or injury are not included. The extent of the exudate has generally been estimated by the return flow through the irrigating tube used to wash out the cavity, which method, as will be explained later, has been found to be reliable.

[17] Monatssch. f. Gyn., 1903, lvii, 441.

[18] Inaug. Diss. 1882 (quoted by Nebesky).

[19] Monatssch. f. Gyn., 1899, ix, 591.

[1] Read at a meeting of the Chicago Medical Society, November 21, 1906.

Through the courtesy of Drs. Hotchkiss, Peck, and Martin, who have been using, at the Roosevelt Hospital, essentially the same methods as myself, I am enabled to add their cases to mine, and can report a much larger and consequently more valuable series than if restricted to my own.

The series includes 78 cases of diffuse peritonitis due to appendicitis, contributed by Drs. L. W. Hotchkiss, C. H. Peck, W. Martin, and myself; 13 due to the perforation of gastric and duodenal ulcers and to traumatic perforations of the upper intestine, all with extravasation of gastric or intestinal contents, contributed by Dr. Peck and myself; and 8 cases of my own, caused by the perforation of typhoid ulcers. The series includes all the cases occurring in our services since the treatment to be described was begun, but does not include earlier cases treated by other methods. I have added my cases of typhoid perforation to the series because they prove that good results may be obtained by these methods, although, as a rule, they are unsuitable for the comparison of the methods of treatment of peritonitis.

The treatment of diffuse peritonitis may be divided into two phases: the operative and the postoperative treatment. The principles of our operative treatment are as follows: (1) To remove, as rapidly as possible, through a small incision, the origin of the inflammation, (2) to wash or irrigate the peritoneal cavity, and (3) to use as little drainage as possible, and not to attempt to drain the general peritoneal cavity. I think no one disputes the necessity of a rapid operation. The lessened time diminishes shock and the additional toxemia and irritation of the respiratory tract caused by the anesthetic.

The desirability of washing out the peritoneal cavity is disputed, the chief objection to my mind being the additional time required. In a few cases it may be carried out while the appendix is being removed or a perforation closed. In most instances, however, this is impracticable and the washing constitutes a distinct part of the operation. Even then, with the proper apparatus, it can be accomplished in from three to five minutes, and does not unduly prolong the operation. Another objection raised by many is that it entails additional traumatism. We have not found this to be true. The double-current irrigator works at its best through a small incision and does not injure the peritoneum.

The imperative indication for washing, to my mind, is the presence of extravasated gastric or intestinal contents in the peritoneum, for it seems to me at least undesirable to leave such foreign material. We might as well leave it in an ordinary wound. In our 13 cases of gastric perforation, food remnants in varying amounts were removed with the irrigator from remote portions of the abdomen. This matter, if left in the abdomen, would undoubtedly act as foci for the maintenance of the diffuse peritonitis or for the institution

of local abscesses. Washing with the double irrigator removes this matter rapidly and, apparently, thoroughly, and with much less damage and shock than by any other method of cleansing. Our results in these cases fairly prove this point.

Of the 13 patients, the only ones that died of peritonitis were 3 in whom perforation had existed for over thirty-six hours, the only other death in the series being due to intestinal obstruction from adhesions on the twenty-sixth day after operation. Recovery also ensued in 4 out of 8 cases of typhoid perforation treated by me in this way. These results, I think, prove that irrigation is at least useful in cases of extravasation of gastrointestinal contents.

I have elsewhere described the irrigator[2] we have used in these cases, and at present it is only necessary to say that its efficiency is largely due to the fact that the fluid is removed by siphonage as rapidly as it is introduced, so that a peritoneal pocket or fossa may be rapidly washed out without diffusing the pus or other matter, and then the instrument is passed into another region and the whole peritoneum is thus systematically cleansed. All parts of the cavity can be reached through a small incision, thus avoiding large incisions and evisceration. Washing in this way accomplishes quickly what is more slowly and imperfectly performed by drainage of the general cavity. In other words, lavage may be considered as rapid drainage. Lavage completed, the usually small wound is rapidly closed with a few stitches of catgut, leaving a small opening only for drainage. The drain, unless deep drainage is indicated, simply passes through the wound and just enters the abdominal cavity, thus allowing the excess of the irrigating fluid to escape and preventing suppuration of the wound, which usually occurs if it is omitted. If any indication for deep drainage exists, such as imperfect removal of the cause of the peritonitis, unsafe closure of perforations, necrotic material or oozing, a suitable drain is carried to the site just as would be done if no diffuse peritonitis existed. The patient is then returned to bed in the Fowler position, and copious rectal salines are used. The salines are administered in different ways according to the indications. I am much in favor of an intermittent irrigation of the pelvic colon through two long rubber tubes, the inlet tube being smaller than the other. These tubes are left in place, and every three or four hours during the first forty-eight hours or so a slow irrigation, lasting from thirty to forty minutes, is carried out, the temperature of the fluid used being from 110° to 115° F. Large quantities are absorbed in this way, gas is removed, and the heat not only stimulates the patient generally, but the intestines also, and promotes peristalsis. We have also used the constant slow method advocated by Dr. Murphy with much success. The stomach is usually washed out on the table

[2] Surg., Gyn., and Obst., May, 1906.

and no food is given until peristalsis is re-established. Morphine is given immediately after the operation to give rest, but not after the first twenty-four hours. Early catharsis is not employed. The Fowler position is used not for drainage purpose, but because it seems to enhance the patient's comfort and diminish vomiting.

If we compare the treatment outlined with the very successful treatment recommended by Dr. Murphy, of Chicago, we find that it is exactly the same in all details excepting the manner in which the septic material is removed from the peritoneal cavity, and consequently the advantages of one method over the other, if any, depend upon the relative advantages of peritoneal lavage and general peritoneal drainage. These have been discussed many times, and some of the discussions are most interesting, even if some of the arguments and conclusions are fallacious.

In the first place, we must take it for granted that the improvement in the results of the treatment of this class of cases has been general, and has not been so dependent upon whether lavage or general drainage has been employed as upon the increased rapidity in getting the patient off the table, the use of large quantities of fluid by the bowel, rest for the entire gastrointestinal tract, and possibly the Fowler position. Still we should leave no stone unturned in our endeavor to save these desperate cases, and so I may be pardoned if I advance my views in favor of washing *versus* drainage, if for no other purpose than to provoke discussion.

I have already mentioned, as one of these advantages, the removal of foreign matter other than the peritoneal exudate. I also think that the septic products of bacterial growth can be more securely eliminated by lavage than by drainage. In regard to this point, it seems to me that the physiological and physical properties of the peritoneum are usually misunderstood. There seems to be a prevailing impression that soluble substances mainly escape from the peritoneum directly into the lymphatic vessels by a sort of filtration. This assumption, it seems to me, is rendered improbable if not disproved by the investigations of Orlow and Adler and Meltzer,[3] which show that absorption from the peritoneum is almost entirely by osmosis. For example, the absorption of isotonic salt solution is very much slower than of solutions of lower concentration. It is extremely probable that the converse is also true in peritoneal inflammation, namely, that the formation of toxic substances produces concentration of the peritoneal fluids and causes osmosis of the fluids from the tissues into the peritoneum, thus accounting for the accumulation of fluid exudate. In any event, the supposition that under certain conditions, as when the tonicity of the blood is decreased by saline infusions or by rectal absorption, a reverse current is established in the lymphatics and toxic substances are washed

[3] Jour. Exper. Med., 1896, vol. i, No. 3.

from the "absorbents" into the peritoneum, thus enabling them to be removed by drainage, is untenable. Under such conditions the blood and tissue fluids become hypotonic to the peritoneal exudate and a definite interchange is instituted according to the laws of osmosis, and the water in the blood and tissues passes into the peritoneal cavity, and substances in solution, that is, toxins, etc., pass, to a certain extent, into the tissues and vessels. Consequently, dilution of the blood, while the peritoneal exudate is left in a condition of septic concentration, must be a source of danger. In other words, when a peritoneum filled with septic exudate is simply drained, the increased flow of drainage noted, when large quantities of fluid are given by the rectum, represents, to a great degree, so much innocuous water, while the septic products are absorbed into the circulation to be eliminated by the kidneys and other excretory organs. On the other hand, if the septic products are removed from the peritoneum by irrigation, with a hypotonic saline solution, such as the ordinary 0.6 per cent. solution, and a certain amount is left in, an osmosis is at once instituted by which the water is absorbed from the peritoneum by the tissue and blood, while the septic products present remain in the peritoneal cavity, and consequently septic absorption, for the time being, is arrested. That there is an arrest of absorption is evidenced by the drop of temperature observed immediately after operation, except in cases that are already generally septic. The danger of disseminating the infection by lavage is, I think, overestimated. The process in these cases is already diffuse, and irrigation with a double-current instrument is not likely to spread it farther. Irrigation, of course, should not be done in local peritonitis, particularly when the limiting adhesions have been broken up, sponging being sufficient in these cases. Even if a few bacteria are carried by the washing solution to remote portions of the peritoneum, they are quickly taken care of by the phagocytes, which, although stimulated and increased, have not, as yet, suffered in vitality. As we well know, pus often flows over the healthy peritoneum when an abscess is opened without provoking inflammation. Further, it must be remembered that the exudate has no opsonic power and that the phagocytes in it are satiated or killed. Its rapid removal by washing allows an escape of active fluids and cells which will not be neutralized by toxic substances in the exudate. Even if saline solution is left in the abdomen, its absorption is so rapid that little is to be feared from its diluting protective substances.

In regard to drainage, if one, after irrigating, can feel assured that he has left nothing in the peritoneum but what can be absorbed, there is no need of drainage. If he has left something which probably will not be absorbed, he should drain, but he should only drain to the doubtful substance. Of course, one drains to an insecure spot; the drain is then a sort of safety valve.

We are all familiar with Dr. Ochsner's method of localizing and preventing diffuse peritonitis. Under it, undoubtedly, the outlying zones of moderate peritoneal inflammation that are filled with a seropurulent exudate undergo resolution and the exudate is absorbed. In many cases of appendicitis there is a fairly active exudation of seropurulent fluid in the vicinity, but without gross perforation of the appendix. With the removal of the appendix the fluid is rapidly absorbed. Such cases would often, in the ordinary course of events, go on to a definite diffuse peritonitis; yet, with the cause removed, they resolve, and they resolve without washing or drainage. When, in diffuse peritonitis, drainage of the entire cavity is attempted at the most dependent part, there must be portions which are not entirely emptied of the septic fluids, but these fluids become absorbed. There is ample proof, in other words, that the peritoneum will take care of considerable amounts of septic material, and we have found that after irrigation what little septic material is left is readily taken care of without the need of drainage. If, by accident or otherwise, material sufficient to cause continued suppuration has been left it has produced local abscesses, and these have been successfully opened later on. These secondary local abscesses have not occurred more frequently in cases not drained than in those drained. In the 99 cases there were 4 in which secondary abscesses occurred during convalescence, 2 in the undrained and 2 in the drained.

A patient not included in the series, and still in the hospital, was not irrigated but drained to the stump of the appendix and to the pelvis, through a stab wound over the pubes. In spite of the Fowler position, this patient developed an abscess between the liver and the hepatic flexure of the colon, on the fourteenth day after operation. From this it is evident that the manner of the treatment has not had much bearing upon the occurrence of secondary abscesses.

In comparing our fatal cases, I have also found that the employment of drainage, apparently, has had little influence on the results. Of the 78 cases of diffuse peritonitis caused by appendicitis death occurred in 15, a mortality of 19.2 per cent. Of the patients who died, 7 were not drained and 8 were drained, 7 to the stump of the appendix and 1 to the pelvis; 2 of the patients who were not drained recovered from the peritonitis, 1 dying on the sixth day, the cause not being determined, and 1 on the fifth day from double pneumonia, the autopsy showing that the peritonitis had resolved; 2 of the patients who were not drained and 2 who were drained were practically moribund and died within a few hours. The remaining deaths were due to sepsis and continuation of the peritonitis. The mortality percentage may seem large, but it must be remembered that these are unselected cases occurring in a very active ambulance service in one of the worst districts of the city, and that our policy has been not to refuse the hope derived from an operation. Of the

patients with appendicitis who recovered, 31 were not drained, 28 were drained to the stump of the appendix, and 4 were drained to the pelvis. Of the 13 patients with peritonitis caused by perforations or ruptures of the stomach and upper intestine, 4 died, a mortality of 30.7 per cent. Of those who died, 2 were not drained and 2 were drained to the suture line in the stomach. One of the deaths in the not drained was due to intestinal obstruction from adhesions on the twenty-sixth day after operation, the peritonitis having resolved. In this case, pylorectomy had to be done to get rid of the ulcer, as it was impossible to suture it. The other 3 deaths occurred in patients who had perforated over thirty-six hours before operation. Of the 9 recoveries in the stomach series, 4 were not drained, 4 were drained to the suture line in the stomach, and 1 was drained to the pelvis. Of the 8 patients with perforation of typhoid ulcers, 4 died, of whom 3 were drained and 1 was drained to an abscess in the pelvis. Of the typhoid patients who recovered, 2 were not drained and 2 were drained to the pelvis, there being abscesses present. In the typhoid cases the head of the bed was only slightly raised.

In explanation, I may say that the abdominal wounds were drained in practically all, and when a case is stated as not to have been drained it refers to the peritoneal cavity. When drains have been passed to the site of the appendix or to the suture line in the stomach, in cases of perforation, of course, local drainage alone was instituted and not general drainage. In the few instances in which drains were passed to the pelvis, the peritoneum may be considered to have been generally drained, although the drains were not inserted for that pupose.

In conclusion, I may say that one cannot wholly estimate the success of a therapeutic procedure by statistical tables. Personal impressions seem to me to be more reliable if derived from sufficient observation. It is my belief that our patients have made smoother recoveries by the omission of drainage when possible, and I cannot look back with regret upon an occasion when I have omitted it. On the other hand, it is impossible to draw hard-and-fast lines as to the method of treatment of these cases, and judgment must be continually exercised. Some need drainage, some do not; some seem to do better with irrigation, others get well without irrigation or drainage; and some die whether drained or not, washed or unwashed.

REVIEWS.

THE PRACTICE OF OBSTETRICS. IN ORIGINAL CONTRIBUTIONS BY AMERICAN AUTHORS. Edited by REUBEN PETERSON, A.B., M.D., Professor of Obstetrics and Gynecology in the University of Michigan. Pp. 1087, 523 engravings, and 30 full-page plates. Philadelphia and New York: Lea Brothers & Co., 1907.

IN the preface we are told that this good-sized volume is designed above all to be practical, without neglect to theory. It opens with a section on the physiology and development of the ovum, by Dr. Huber, of the University of Michigan, who gives a clear and concise account of the subject from the standpoint of modern research. In stating the length of the embryo, the table commonly ascribed to Dührssen is credited to Hasse. In describing the decidua, the older terms, serotina and reflexa, are retained. The syncytium and Langhans' layer of cells are attributed to the fœtal ectoderm. The placenta is said to contain both a fœtal and maternal circulation.

The physiology of pregnancy receives treatment by Dr. Manton, of Detroit. The more modern view that the maternal heart is not hypertrophied during pregnancy is accepted as established. In treating of the urinary system during pregnancy, it is stated that the urea and solid constituents of the urine remain practically unchanged, but subject to normal variations. This has not been our experience, as we rarely see a pregnant patient in whose urine the solid constituents are not considerably altered in composition and quantity. No mention is made of altered function in the liver or other important organs connected with metabolism during pregnancy. Nausea and vomiting are considered as among the usual symptoms of pregnancy. In the next chapter, by the same author, on the diagnosis of pregnancy, vomiting is said to take place in only 49 per cent. of pregnant women. On the following page vomiting is recognized as sometimes due to toxemia, and as a symptom of importance. Perverted appetite is not, however, considered uncommon. The mammary changes caused by pregnancy are described in detail, and well illustrated. In diagnosticating pregnancy, external ballottement is regarded a symptom of value. This has not been our experience.

The physiology of labor is described by Dorland in a paper which is considerably illustrated. The old nomenclature of the various mechanisms of labor is retained, and the old divisions into four

essential positions. Many of the phenomena of labor and its management are illustrated by photographs taken in the Maternity Department of the University of Michigan, with which the writer is not connected. It is usual for authors personally to superintend the preparation of photographic illustrations. The author takes occasion to warn, at some length, against the use of ergot during labor, a caution which we had supposed was scarcely necessary.

The physiology of the puerperal state is treated by Dr. Lewis, who advises that the cervix be exposed and lacerations sutured, should hemorrhage occur while the uterine body is firmly contracted. We have found it more advantageous to inspect the cervix and to close all considerable lacerations without waiting for hemorrhage. In considering the patient's posture and length of time in bed, it is said that danger of air embolism from turning is practically over in six hours after labor. It is questionable whether air embolism causes sudden death after labor, and the weight of evidence is in favor of the belief that such accident arises from cardiac clot, usually in the right side of the heart. The author wisely urges against the use of the catheter in the puerperal period if it can be avoided, and describes fully the antiseptic precautions necessary for such employment. We agree fully with him in the statement that ergot is the best means for preventing after-pains. Combined with strychnine it is of especial value. The author, however, urges against the routine use of ergot during the puerperal period. We believe that small doses of ergot, combined with strychnine, are beneficial to the majority of puerperal patients, producing good involution without injurious effect. Massage for puerperal patients is described at some length, and the knee-chest posture is advised. The necessity for thorough examination of all puerperal patients is urged.

Lactation is considered fully by Bacon, and the subject illustrated. In performing massage, he does not rub from the periphery toward the nipple, but commences in the axilla and under the clavicle. He employs alcohol freely upon the nipple to prevent infection.

The pathology of pregnancy is described by Ehrenfest, who discusses at length the toxemia of pregnancy. He does not ascribe much importance to the study of nitrogenous metabolism, but would confine his attention to the action of the kidneys. In treating the pernicious nausea of gestation, his choice of nutrient enemas has not been that most successful in our experience. Under disorders of the osseous system there is no mention of rachitis.

Considerable space is given to the pathology of the placenta, the decidua, the chorion, amnion, umbilical cord, and the fœtus, by Warthin, of Ann Arbor. These chapters are full, interesting, and well illustrated. Much-needed directions are introduced for performing an autopsy upon the fœtus or the newborn child.

Ehrenfest writes of the premature expulsion of the ovum, and urges the digital removal of the ovum when an operation is inevitable.

The dull curette is sometimes a useful adjunct. In criminal abortion, he properly warns against the employment of the sharp curette.

Schenck writes of extrauterine pregnancy, giving the diagnosis of the condition very fully. Immediately after rupture, operation by abdominal section is urged. In long-standing cases with hematocele, vaginal section is preferred. The pathology of labor is opened by a chapter on dystocia due to anomalies of expulsive forces. This gives place for a chapter by Ehrenfest, upon pelvimetry, which would seem to indicate that the measurement of the pelvis is a procedure to be employed in pathological conditions only. The reasons are not apparent why this chapter was omitted from the complete diagnosis and examination of pregnant women. Moran, in a well-illustrated article, writes upon labor complicated by anomalies of the bony pelvis. In discussing treatment, he recognizes the fact that Cesarean section is successful in proportion to the uninfected condition of the patient. Section should not be done on patients repeatedly examined when the most rigid antiseptic precautions have not been taken. He states confidently that when the conjugata vera is above 9 cm. symphysiotomy and Cesarean section should not be considered. This is not invariably the case, as the elective Cesarean section may be necessary under these conditions. Dystocia due to anomalies in the fœtus and its presentation or development also receives attention by Moran.

Moran writes at length upon eclampsia, and takes the ground very properly we think, that care should be taken to avoid violence in efforts at delivery.

The pathology of the puerperal state is described by Lewis, who advises starvation and the use of cold externally for appendicitis. When the uterus is displaced during convalescence, if subinvolution is present, curetting should be done. The knee-chest posture is always indicated; tampons and pessaries may also be employed.

Puerperal infection, also, is described by Lewis, who recognizes the danger of bath-water as a source of infection. The uterine pathology in infection is minutely described, and methods of examination for puerperal infection are also given. Uterine douches are sometimes indicated, and the blunt curette may also be used. Salt solution is valuable, but antistreptococcic serum has proved unsatisfactory.

Crockett writes upon the obstetric operations. Care is taken to illustrate well-fitting and ill-fitting rubber gloves, and stress is laid upon their employment. Curetting and gauze packing are described, and the use of salt solution by transfusion is fully illustrated. The induction of premature labor is described by the same author, with photographs and reproductions which are familiar. In treating lacerations, no mention is made of laceration of the anterior segment of the pelvic floor and the tissues about the urethra. This

accident occurs not infrequently and always demands attention. In the chapter on forceps, by the same author, no axis-traction forceps but Tarnier's is mentioned. We agree with the writer in cautioning against the use of forceps when the head is not engaged in the pelvis.

In treating of Cesarean section, his nomenclature is peculiar. He describes the abdominal conservative operation, the abdominal Porro operation, panhysterectomy, and vaginal section. He confuses abdominal celiohysterectomy with intraperitoneal treatment of the stump with the original Porro operation.

Lewis writes of the care of the newborn; Bacon of premature infants; Lewis of artificial feeding, concluding the volume with a chapter on the diseases of the newborn. In describing by illustration the so-called Byrd-Dewey method of resuscitating a newborn infant, the child is not held with the head downward; this is a matter of some importance, as mucus is thus more readily expelled from the child's mouth. Schultze's swinging method is illustrated, but unfortunately with imperfect photographs.

The volume contains much of interest, is clearly printed, and has among its illustrations some excellent photographs and some clear and good cuts. The illustrations, however, are not of uniform excellence. E. P. D.

ABDOMINAL OPERATIONS. By B. G. A. MOYNIHAN, M.S. (Lond.), F.R.C.S., of Leeds, England. Second edition. Pp. 815. Philadelphia and London: W. B. Saunders & Co., 1906.

THE best indication of the value of this work is the fact that a second edition has been called for within a year. The changes, of course, are not very extensive, but a number of new illustrations are to be found, as well as certain changes in the text. The extent of the work, as relates to subjects, however, has not been increased. The author does not include any of the gynecological operations, nor those on the kidney, ureter, or bladder. He also has excluded hernia. We think that the omission of the various operations for the different forms of abdominal hernia is to be regretted. The author does not undertake to describe all the operations for the different pathological conditions found in the abdominal organs, but chooses those most in use and those which he has found practical. In his chapter on the treatment of general peritonitis we think that the omission of the Murphy method of operating in these cases is a mistake. Great attention is paid to the preparation of the patient for operation, and also to the after-treatment. Personally, we are not inclined to agree with the early feeding by the stomach which the author recommends after operations upon perforated gastric ulcers, believing that the longer food is kept out of the stomach

the greater the chance for thorough healing of the ulcer, and the lessened likelihood of future operation. In dealing with the treatment of gastroptosis one is rather struck with the fact that the author does not recommend gastroenterostomy, which would appeal to us as a simpler method in treating this condition than that of trying to elevate the stomach to its original position with all the chances of future elongation of the adhesions and recurrence of the trouble.

The book is written in a comprehensive manner and is full of valuable practical advice to surgeons. The technique is always simple, as few assistants and as few mechanical aids as possible being advised. The author has a forceful and confident manner of expressing his views, and the simplicity of his style is one of the attractive features of the book. The illustrations are excellent, and the work is such a thorough and reliable guide to the operating surgeon that we believe it will rank as one of the best books of its kind.

J. H. G.

THE SURGICAL ASSISTANT. A MANUAL FOR STUDENTS, PRACTITIONERS, HOSPITAL INTERNES, AND NURSES. By WALTER M. BRICKNER, B.S., M.D., of New York City. New York: International Journal of Surgery Company, 1906.

THE OPERATING ROOM AND THE PATIENT. By RUSSELL S. FOWLER, M.D., Surgeon to the German Hospital, Brooklyn, New York. Pp. 172. Philadelphia and London: W. B. Saunders Company, 1906.

A NURSE'S GUIDE FOR THE OPERATING ROOM. By NICHOLAS SENN, M.D., PH.D., LL.D., C.M., Professor of Surgery, Rush Medical College, in affiliation with the University of Chicago. Pp. 204. Second edition. Chicago: W. T. Keener & Co., 1906.

SURGICAL SUGGESTIONS: PRACTICAL BREVITIES IN DIAGNOSIS AND TREATMENT. By WALTER M. BRICKNER, M.D., Chief of the Surgical Department, Mount Sinai Hospital Dispensary; and ELI MOSCHCOWITZ, M.D., Assistant Physician, Mount Sinai Hospital Dispensary. Pp. 58. New York: Surgery Publishing Company, 1906.

THE technique of present-day surgery constitutes no small or unimportant part of the art, and it is important that the assistants and nurses should understand its importance and practice it with as scrupulous care as the surgeon himself. This being true, there is a distinct place for such books as the above, and it is well they should be written by experienced operators.

Brickner's *Surgical Assistant* is somewhat new in its scope, but it fills a want which many surgeons have felt. It undertakes to

show the assistant, whether he or she is a hospital interne, a general practitioner, or a nurse, what the duties of an assistant are and how to perform them. There can be no doubt, after the careful perusal of this small volume, that it is a book which may be studied with advantage by all hospital internes and nurses. The first chapter deals with the general conduct of the assistant in his relations to the surgeon and to the patient, and contains a great deal of good advice. The remaining chapters of Part I deal with the assistant's conduct during the preparation of a patient, the operation, and the immediate postoperative care of the patient. In Part II the various operations are taken up, and special attention is paid to the part the assistant plays in them. As an appendix the various preparations of surgical materials are considered and the various surgical instruments illustrated.

Fowler's *Operating Room and the Patient* may be accepted as a thorough and complete description of a modern operating room and a reliable guide to the preparation of the patient, instruments, dressings, sutures, etc., for the different operations. The last chapter is composed of lists of instruments required for operations on different parts of the body, and will be found useful to a clinical nurse or assistant preparing for an operation, especially if it is to be done outside of a hospital. The arrangement of the operating room, the preparation and the preservation of different materials needed, are given in detail. Under the subject of anesthesia we regret the omission of ethyl chloride as a general anesthetic. The use of ethyl bromide is described, but we do not think this agent is as deserving of confidence as the chloride, nor is it being so extensively employed. In describing the preparation of the patient for operations on the stomach no mention is made of the importance of cleansing the mouth for some days before operation. The different positions which the patient should occupy on the operating table are well illustrated, but there seems to be no necessity for picturing the patient in the "altogether."

Senn's *Nurse's Guide* is a second edition. Its basis is a course of lectures delivered to nurses. It is not as extensive as the two preceding works, but as it is written for nurses alone this can hardly be a fault. The various instruments used in surgery are illustrated, which must prove of value to the nurse.

Surgical Suggestions, by Brickner and Moschcowitz, is composed of terse statements regarding diagnosis and treatment of different diseases arranged anatomically. The following extracts illustrate very well the character of the text: "In seeking a cause for torticollis do not fail to examine the teeth." "Ascites in the presence of a mass in the pelvis usually, but not necessarily, means malignancy." This small volume is filled with other such rules which will be found of invaluable benefit to the general practitioner and the occasional operator. J. H. G.

DAS PROBLEM DER SYPHILIS. By PROF. DR. O. ROSENBACH. Berlin: August Hirschwald, 1906.

THIS book of 164 pages is a second edition, testifying to its cordial reception by the profession, for the thinking portion of whom it was written. Everywhere the subject is discussed in a broad and scientific manner worthy of so distinguished an author and practitioner. The subject matter is considered on distinctly original lines, as evidenced by the first chapter, which goes thoroughly into the question of "specific remedies." The conclusion is reached that experience teaches that the influence of the individuality upon the origin, development, natural course of the disease, as well as upon the forces influencing the disease, are all of the greatest significance. The syphilitic subject, laboring under the action of the specific virus, is to be regarded as a bearer of contagion only so long as ulcerative primary processes, diffuse eruptions, and moist papules are produced. The glandular swelling, which shows the existence of constitutional disease, is to be regarded merely as a sign of strong general reaction, and, in the later stages, as a remnant which generally terminates in spontaneous recovery. After the period of recent manifestations has passed it is neither an expression of the specific nature of the disease nor the seat of a specific virus. The author carries out these lines of thought still farther. Notwithstanding that in the majority of cases these stages of the disease may be distinguished, this chronological division should be set aside, inasmuch as, according to the individual proportions, the symptoms, which are the expression of a general disturbance of nutrition, may be precocious. For the sequels of syphilis the author takes the ground that specific treatment should be employed with reserve, inasmuch as mercury, so useful in the early eruptions, possesses no action as a prophylactic nor in preventing relapses. The treatment of local or constitutional diseases, and their sequels, in the author's sense, should follow the same principles as in the handling of all constitutional diseases characterized by secondary symptoms. The patient should be under the observation of the physician treating him for at least one year from the date of the first cutaneous symptoms; and here Dr. Rosenbach directs attention to the interpretation of the many cutaneous and other symptoms that during this period are liable to appear, and their proper treatment, as bearing upon not only the use of drugs but also of other methods of coping with the disease. The author sees much in syphilis beyond the bare symptoms which every general practitioner readily can see, and points the way to the proper care of the patient as being of much more importance than stereotyped medication. The book is replete with interesting and valuable reading matter, and in scope and style is quite unlike any other similar treatise on the subject. We should like to see the little volume translated into English.

L. A. D.

ATMOKAUSIS UND ZESTOKAUSIS: DIE BEHANDLUNG MIT HOCHGESPANTEN WASSERDAMPF IN DER GYNAEKOLOGIE. (ATMOKAUSIS AND ZESTOKAUSIS: THE GYNECOLOGICAL TREATMENT WITH STEAM AND HIGH PRESSURE). By DR. LUDWIG PINCUS. Second edition. Pp. 371. Wiesbaden: J. F. Bergmann, 1906.

THIS interesting monograph is an exhaustive review of the author's extended experience with a method of treatment which has received comparatively little attention in America, principally because of timidity and unfamiliarity with the technique, simple as the latter is. The first section of the first part of the book (pages 12 to 189 inclusive) is devoted to the history and development of the operation, including a reply to the various criticisms that have been urged against it. The following cautions are emphasized: (1) Thirty seconds should be regarded as the *maximum* time during which steam should be allowed to enter the uterine cavity. (2) The treatment must not be repeated until *complete regeneration of the endometrium has taken place.*

The second and third sections deal with the apparatus, and the proper method of using it, in order to avoid the sloughing and subsequent cicatrization of the soft parts of which many operators have complained.

An interesting chapter on experimental work is followed by one on anatomy, the latter being fully illustrated by photographs of uteri, showing the results obtained by the application of steam for varying periods of time, and the fact that its effects can be controlled by careful attention to the rules laid down.

The second half of the monograph is devoted to clinical facts, stress being laid upon the following points as necessary to the success of the treatment: thorough asepsis, thorough dilatation of the cervical canal and preliminary cleansing (*not curettement*) and drying of the uterine cavity, and the recognition of contraindications, especially disease of the adnexa. Narcosis is not necessary, as a rule. The treatment should not be attempted during menstruation, unless it is absolutely necessary to check serious hemorrhage. Strict rules are given with regard to keeping patients in bed under careful observation for not less than four days. The various indications and contraindications for atmokausis and zestokausis are given at length (pp. 229–239), so that the reader may infer that this method of treatment has been as carefully developed as the technique of any modern operation—if not more so. These have already frequently appeared in current literature and need not be repeated.

Preclimacteric bleeding is regarded as the most important indication for atmokausis, malignant disease being carefully excluded. The author states as a positive rule that total extirpation should never be performed for hemorrhage alone until atmokausis has had repeated trials. A number of successful cases is cited. The results

in cases of hemophilia are stated to be especially gratifying. The precautions to be observed in cases of hemorrhage due to fibroids are worth careful attention. Submucous growths, irregular depressions in the uterine cavity, are to be regarded as positive contraindications. In fact, the writer is careful to give the impression that the treatment should be limited to cases of hemorrhage in which on account of great weakness or cardiac complications a radical operation is unjustifiable.

Menorrhagia and metrorrhagia in childbearing women, in whom hemostasis alone is indicated, is contrasted with cases in which actual obliteration of the uterine cavity is desired, as in women with incurable diseases. Special sections follow on the treatment of subinvolution, senile endometritis, membranous dysmenorrhœa, and chronic gonorrhœal endometritis, in each of which different precautions are to be observed. The concluding section is devoted to the limitations of zestokausis, the gist of which is that the zestocautery is to be regarded as a sort of mild thermocautery in which an eschar seldom results.

This monograph concludes with an exhaustive bibliography, no less than four hundred writers being quoted. We are sure that the American reader who recognizes the great care with which the author has developed his method of treatment, will be induced to lay aside his prejudices against it and accord it a fair trial.

H. C. C.

THE DISEASES OF THE NOSE, THROAT, AND EAR. By CHARLES PREVOST GRAYSON, A.M., M.D., Clinical Professor of Laryngology in the University of Pennsylvania. Pp. 550. Second edition. Philadelphia and New York: Lea Brothers & Co., 1906.

THIS book is not only a thorough revision of the previous edition, but shows very extensive additions and alterations to the text. It is intended primarily for the use of students and beginners in the practice of rhinology and laryngology, and in fulfilment of this aim its author has shown the result of his long experience as a teacher in the University of Pennsylvania. In clear, concise diction he gets at the gist of his subject and presents it in easily assimilable form. One especially valuable feature of the work is the emphasis laid upon the relation of local lesions in the nose and throat to constitutional disorders. In Chapter IV there will be found a particularly good discussion of this subject. The author may possibly be regarded as holding rather strenuous views on the importance of faulty metabolism in various pathological conditions in the upper respiratory tract, but he advances good sound logic in support of his tenets. His discussion of chronic rhinitis contains

a very interesting, if somewhat lengthy, quotation from an article previously published by him on the relation borne by sexual excitements to nasal disorders. This subject is but seldom considered, and yet is undoubtedly one of great importance, as any rhinologist of experience can testify. In dealing with that mysterious symptom-complex, hay fever, the author very candidly states how unsatisfactory most of the loudly proclaimed methods of treatment have proved. He mentions, only to condemn, the treatment with so-called "liquor ambrosiæ," and he rather slyly intimates that "pollentine" may soon be cast into the limbo with the ambrosial fluid. Another strikingly good feature of the book is the section on laryngeal tuberculosis, a subject possessing great difficulty and too often handled merely in a routine manner. In conclusion, we would say that the book will certainly hold the position which it has already achieved as a first-class practical manual for the student or practitioner beginning the study of laryngology. F. R. P.

THE TECHNIQUE OF OPERATIONS UPON THE INTESTINES AND STOMACH. By ALFRED H. GOULD, M.D., of Boston. Pp. 302. Philadelphia and London: W. B. Saunders Co., 1906.

THIS book contains the result of an experimental study of gastrointestinal technique, the object being to simplify as far as possible the best gastrointestinal operations. In addition to the original work which has been done the author has included much of that done by Harrington, Nichols, F. T. Murphy, Barbat, and Monks. The first portion of the book deals with the reparative process as it occurs in intestinal wounds after various methods of suture and mechanical appliances for performing anastomoses. It is very interesting and instructive, and is beautifully illustrated. The next portion has to do with suture materials and the method of their use. Here the various intestinal needles, sutures, and knots are described and illustrated. The third portion deals with the anatomy of the intestines, in which Monks is freely quoted and a number of illustrations from his article on intestinal localization employed. The latter portions of the book relate to operations upon the intestine and stomach. Here the different operations are carefully described and excellently illustrated. The illustrations throughout the book deserve especial commendation. We have never seen better. As a guide to technique and to the various steps of gastric and intestinal operations the book will be found most trustworthy. J. H. G.

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The Superficial Extension of the Percussion Shock.—HAMBURGER (*Münch. med. Woch.*, 1906, liii, 2283) lays great emphasis upon the importance of the chest wall in the production of percussion sounds. Between the early view of Williams, that the note arises entirely from vibration of the chest wall, and the later contention of Skoda, that the vibration of the air in the lungs is the sole factor, he accepts with Mazonns an intermediate position, looking to a combination of both as the only satisfactory manner of explaining percussion phenomena. The distinct dulling of resonance which occurs when an assistant, with his hands, compresses the chest wall on either side of the point percussed, appears to Hamburger definite evidence of the part played by the chest wall. The intensity of the percussion note depends upon the wave mass, as well as upon the wave amplitude, and the wave mass is determined by the amount of air in the lung being set in vibration. The percussion stroke is carried not only a certain depth into the lung, but radiates in a circle for a certain distance over the chest, the chest wall acting as a pleximeter. Weil was the first to demonstrate that relative liver dulness and heart dulness do not depend upon the dampening or dulling by the solid organ of the resonant note arising in the superimposed layer of air-containing tissue, but that it is due to the decreased vibrating mass over the solid organs. From experiments on corpses he demonstrated that dulness began at a point where the lung substance was 4 cm. in thickness. Weil took into consideration only the radiation of the percussion shock into the depth of the organ. Hamburger insists upon the equal importance of its superficial transmission. If our percussion

note radiating from the point of origin is able to carry in all directions over the chest wall, say 6 cm., when we approach within 4 cm. of the border of the lung a considerable portion of the circle is cut off and the mass of vibrations equally diminished. The same explanation holds good for the frequency with which a tympanitic note is heard high up in the left axilla: in this instance the air in the stomach is thrown into vibrations. Upon the same basis is explained the areas of paravertebral dulness and paravertebral resonance in pleural effusions. The more elastic the chest wall the wider the area of superficial transmission. The practical importance of the principle is found especially in its application to children. Any position the child may take or any manner of holding it which will compress one side or a portion of a side may give rise to percussion differences which have no pathological basis.

The Pathogenesis of Acute Pancreatic Hemorrhage and Pancreatic Necrosis.—PALYA (*Berl. klin. Woch.*, 1906, xliii, 1562), from a consideration of the views of Chiari and others of the self-digestive action in disease of the pancreas, had his attention drawn to an important factor which had been previously disregarded. The work of Pawlow and his pupils has proved that the pancreatic secretion itself is inactive and that it becomes efficient only when mixed with intestinal juice. This activating power resides in the substance Pawlow calls enterokinase, which in very small quantities can convert the trypsinogen into active trypsin. To determine the importance of the presence of this substance in the gland itself Palya performed four sets of experiments:

1. The injection of intestinal mucosa extracts. (*a*) In 2 animals the extract was injected directly into the substance of the gland. One was positive, 1 negative. (*b*) In 5 the centrifuged extract was injected intraparenchymatously. Three were positive; 2 negative. (*c*) In 3 the centrifuged extract was injected into the duct; 2 were positive, 2 negative. In 2 the centrifuged and filtered extract was injected into the duct; 2 were positive; 1 negative. (*d*) In 4 enterokinese prepared according to the directions of Bayliss and Starling was injected into the duct. All were negative. In the positive cases the animals died within twenty-four hours (1 in twenty-nine hours). Necrosis and hemorrhage of the pancreas and more or less widespread fat necrosis were found. In 3 cases there was simple swelling of the gland, but microscopically this also showed necrosis. Fat necrosis was marked in all but 1 animal, which died in five hours. Of the animals which recovered some were extremely ill and a few even moribund. Later laparotomies revealed a hardening and contraction of the gland, peripancreatic adhesions and, twice, small abscesses in the neighborhood of the duct. That these effects were due to the extract and not to bacteria which may have been introduced is indicated by the facts that fat necrosis seldom follows injection, that the period between injection and death was so short, that the anatomical changes were not those of a bacterial infection, and that the fat necrosis occurred even with the carefully filtered extract. The action of bacterial toxins or of bacterial kinese cannot be definitely ruled out. The entire absence of reaction after injections of enterokinase would seem to reject the supposed activating influence of the extract, but it is possible that the particular

preparation may have been faultily prepared or the presence of too large a quantity of enterokinase may have frustrated its own activity.

2. The injection of intestinal contents. Seven dogs received from 1 to 3.5 c.c. of duodenal contents into the pancreatic duct. In from twenty to thirty hours all succumbed, and all showed most extensive fat necrosis. In 4 the pancreas was the seat of extensive hemorrhage. In the other cases there was simple swelling of the gland, but microscopically all steps from simple parenchymatous degeneration to complete necrosis were observed.

3. In one instance 2.5 c.c. of the filtrate of a colon culture was injected into the duct. The animal after a few days' illness recovered, while a control which received the same subcutaneously died after a few hours.

4. Trypsin experiments. Seven animals were injected with solutions of trypsin and all proved positive. The lesions were as in the other experiments.

The most satisfactory results and the most extensive lesions were obtained with duodenal contents. As explained under the experiments with intestinal mucosa extract, it is hardly possible that the bacteria present could be responsible for the lesion. Nor can the oil, blood, bile, fatty acids or other substances, all of which are present in very small quantities, be an important factor in the light of previous experiments by numerous authors. It is known that a very small amount of enterokinase will activate a large amount of pancreatic secretion, and the uniform positive results following the injections of trypsin indicate that the mode of action of the duodenal contents is by causing such a conversion.

An Experimental Investigation of Sahli's Desmoid Reaction.—SAITO (*Berl. klin. Woch.*, 1906, xliii, 1305). Sahli has suggested a method of ascertaining the functional efficiency of the stomach, depending upon its ability to digest catgut. Small rubber bags are filled with methylene blue or salicylic acid or iodoform and tied with catgut strings. One of these is administered after a meal and the time ascertained when the substance appears in the urine or sputum. Alexander and Schlesinger have shown that various substances are excreted by the same patient in different lengths of time, and in making comparisons a given substance must be constantly used. In disturbed gastric activity there is a distinct lengthening of the reaction time, most noticeable in subacidity or anacidity. Three factors are of importance in the reaction: (1) The solution of the catgut; (2) absorption of the drug; (3) its excretion. The third factor Saito allows to be constant in normal individuals, and proceeds to an examination of the other two. By a large number of experiments he shows that although catgut is not digested by pure pancreas secretion nor by pancreas secretion and gastric juice, nor by gastric juice and intestinal secretion, yet the mixture of pancreas secretion and intestinal extract will dissolve it in from six to twenty-seven hours. In cases of lost gastric secretion the desmoid, therefore, may still appear. Allowing that in a given case the catgut is dissolved in the stomach, there are other factors which may interfere with the correct interpretation of results. Saito shows that the rapidity of solution of the catgut depends upon the concentration of the digesting fluid, and

this varies with the amount of food taken, the quantity of juice secreted, and the mechanical mixing power of the stomach. These factors, of course, are very variable and are difficult to control. In regard to the absorption of the drug he shows that methylene blue and iodoform are taken up only in the intestine. They must be discharged from the stomach before the reaction can appear. The motor function of the stomach, therefore, is an important factor. He concludes that the desmoid test is influenced by so many uncontrollable factors that it is of little use in diagnosis.

The Improvement Caused in Leukemia by Intercurrent Infections.—FUNCK (*Berl. klin. Woch.*, 1906, xliii, 1308) reports a case of myeloid leukemia with attacks of renal colic caused by the impaction of masses of uric acid crystals in the ureter. The blood was examined with care and particular emphasis laid upon the differential enumeration of the polymorphonuclear cells according to the method of Arneth. Arneth classes the polymorphonuclear cells according to their age; the more lobules the nucleus possesses the older the cell. Those with only indented nuclei he puts in Group I; those with two lobules, in Group II, and so on. He thinks that the ripe leukocytes are the ones that succumb first to an infection and by their disintegration supply antibodies. The patient, a young man, aged twenty-eight years, showed at his first visit an enlarged spleen, slight swelling of the cervical, submaxillary, and inguinal glands, and with the fluoroscope enlarged bronchial glands. The hemoglobin was 48 per cent.; the red cells, 2,930,000 with 5 per cent. of erythroblasts; the leukocytes 86,000, of which 48 per cent. were neutrophile; 28 per cent. eosinophiles; 11 per cent. mastzellen; 13 per cent. lymphocytes. 22 per cent. of the neutrophiles were myelocytes. Under *x*-ray treatment the leukocytes fell after one and a half months to 12,800, and the neutrophiles showed a marked improvement according to Arneth's definition. There were then 84 per cent. of neutrophiles, of which only 3 per cent. were myelocytes. The polymorphonuclear leukocytes of the first class fell from 57 to 11 per cent.; of the second rose from 37 to 52 per cent.; of the third, from 5 to 33 per cent.; of the fourth, from 0 to 4 per cent. *X*-ray treatment was then stopped and under arsenic improvement continued. On May 26, two months after he was seen, the patient had an attack of colic associated with infection of the renal pelvis. During the four days after the attack the number of leukocytes rose, and varied from 22,000 to 26,800. On the fifth day they fell to 10,600; on the sixth to 4200; on the seventh to 5000. On the tenth day they again went to 10,800 and continued over 10,000. In a table Funck furnishes, great improvement is shown during the rise in the number of white blood corpuscles, the neutrophiles rising, the myelocytes falling, and the polymorphonuclear cells going into the higher classes. With the drop in the number of leukocytes, however, is shown a most remarkable fall in the number of neutrophile cells, a drop from 86 per cent. to 12 per cent., and an equally remarkable rise in percentage of myelocytes from 0 to 82 per cent. At the height of the leukocytic reaction all polymorphonuclear cells but those of Class I had disappeared from the blood, Class IV dropping from 61 per cent. on the fourth day to 0 per cent. on

the fifth day. When the infection subsided the blood returned to its previous condition, the neutrophiles rising to 88 per cent., the myelocytes falling to 4 per cent., the polymorphonuclears counting Class I, 12; Class II, 65; Class III, 22; Class V, 1. During the infection the erythroblasts rose to 22 per cent. of the red cells, to again disappear from the blood as it subsided. As is usual in such instances there was a marked decrease in size of the spleen and glands during the reaction. This picture corresponds closely to those usually observed, the infection being accompanied by marked improvement in the number and class of leukocytes, the improvement lasting a variable time and then returning slowly to the condition present before infection. The interesting portion of Funck's table is the remarkable swing to the left in the quality of the cells, while the number of leukocytes is lowest. His explanation of these conditions is this: He considers the bone-marrow too seriously diseased to furnish the great number of polymorphonuclear neutrophiles that flood the blood as the first reaction to the infection. They must come, he believes, from the myeloid areas in the spleen and glands, the sudden discharge accounting for the diminution in size of these organs. This supply, however, is very limited and as the older cells succumb to the infection and the bone-marrow is unable to respond with ripe forms, there is a great diminution in the number of cells, young forms remaining and being added to from the marrow. Funck warns that the number of leukocytes alone is no indication of the condition of the blood. Only a careful morphological analysis can give an idea of its quality. On the days when the count was lowest the patient's blood was in worse condition than when the count was higher.

Tuberculin Treatment of Pulmonary Tuberculosis.—HAMMER (*Wien. med. Woch.*, 1903, liii, 2343) for six years has employed tuberculin in the treatment of ambulatory cases of tuberculosis, and he is confident that its use has been followed by benefit in every instance. There is a tendency at present to restrict its use to treatment of early cases, and while most striking and lasting results have been obtained in this class of cases, Hammer believes that when judiciously used it may be applied with good results in practically all cases. His own material has been, on the whole, unfavorable, drawn from the poorer classes, and embracing advanced, as well as early and moderately severe, cases. He admits, that in a disease which has such protean manifestations as pulmonary tuberculosis, one must judge cautiously of the influence of a given remedy. The patients had not the advantage of good hygiene and diet. He points out that the one important element in success is to individualize; to carry the patient along carefully on a dose just short of the one able to produce a reaction. He has seen a marked general reaction occur after the administration of the 0.002 milligram. The curative action or increased sensitiveness to the drug must be carefully watched. As a rule, he begins with 0.01 milligram; in many cases, however, with 0.001 milligram. This dose is gradually increased until a gram of pure tuberculin is given. Such a course of treatment lasts, as a rule, six months, the injections being given at first twice a week, later once a week. The dose is advanced very slowly and cautiously, the patient being carefully watched, and at the

occurrence of any suggestive subjective symptoms or slight temperature elevation the same dose is repeated or a still smaller dose returned to and a careful ascent again begun. Among the early closed cases Hammer has obtained satisfactory cures; many of the more advanced cases have become stationary, and even in the far advanced there has been a distinct alleviation of symptoms.

The Pathology of Polycythemia Rubra.—GLAESSNER (*Wien. klin. Woch.*, 1906, xix, 1475) reports the occurrence of polycythemia in a man aged forty-four years with tabes. The symptoms for which he sought relief were fulness in the head, headache, shortness of breath, distention of the abdomen, and swelling of the legs. For two years he had himself noticed an increasing redness of the face. He was addicted to alcohol and had had syphilis. There was most intense cyanosis of the skin and mucous membranes, and over the shoulders and buttocks numerous small purpuric spots. The skin over the chest and abdomen was covered with dilated venules. The liver and spleen were both markedly enlarged. Argyll-Robertson pupil and Romberg's sign were present. The blood count on admission was 10,000,000 red cells, 7000 leukocytes, and hemoglobin, 90 per cent. Morphologically, the red cells were normal, except for slight microcytosis and macrocytosis; the leukocytes were present in the usual proportion. Death occurred slowly from cardiac dilatation. The most striking feature at autopsy was the enormous quantity of blood in all parts of the body, not distributed to groups of organs or to a single region, as is common in chronic passive congestion. In the long bones, besides the yellow marrow, there were small areas bluish red in color, showing microscopically a great increase in the number of normoblasts, the leukocytes remaining normal in appearance and in relative proportion. The spleen was much enlarged, firm, and of a deep-red color. Scattered through its substance were numerous small, yellowish-gray nodules, the average about 1 to 2 mm. in diameter. At first appearance these resembled tubercles, but microscopically they consisted of areas of anemia and connective tissue overgrowth. In several of the instances of reported polycythemia a primary tuberculosis of the spleen was found at autopsy. Glaessner considers such an infection secondary and warns against making an error in diagnosis by mistaking the areas above referred to. He thinks the essential and distinctive lesion is the marrow change, the great increase in nucleated red cells. This will aid to distinguish many cases of pseudopolycythemia, which clinically may present the three cardinal symptoms: cyanosis, increased number of red cells, and enlarged spleen. Glaessner quotes a case of stasis in which the cause of obstruction during life was not apparent. The patient was very blue, and had a greatly enlarged spleen; the red cells were 9,600,000, and the hemoglobin, 120 per cent. At autopsy an adherent pericardium and chronic pleurisy were discovered as causes of the obstructed circulation.

SURGERY.

UNDER THE CHARGE OF

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A Simplification of Total Resection of the Bony Chest Wall in Empyema.—BAYER (*Zentralbl. f. Chir.*, 1906, xxxiii, 1) says that for the cure of neglected total empyema Schede's operation is certainly the most radical and surest method. Yet it must be admitted to be very severe for a patient much run down by long-continued suppuration. The hemorrhage resulting from the raising of a large flap of soft tissue is not unimportant. It not infrequently demands, from the occurrence of collapse, an abrupt termination of the operation and its completion at a second sitting. When on account of the unyielding character of the intercostal soft parts over the empyemic cavity it becomes necessary to remove them, the resulting mutilation is enormous. Bayer believes that the purpose of the Schede operation can be attained in very difficult cases by a more simple and conservative operation. A vertical incision about two fingers' breadth beyond the anterior axillary line will cross all the ribs from the third to the ninth or tenth, close to the anterior serrations of the serratus magnus muscle. It will not wound any of the large vessels and will divide no muscles except a few fibers of the external oblique from the seventh rib downward. About 2 cm. of each rib, beginning below at the ninth or tenth and going upward to the third, may be quickly removed subperiosteally with forceps. The intercostal soft tissues and pleura are then divided in this line with a thermocautery to prevent bleeding from the intercostal arteries. If necessary, the second rib may be removed by elevating the arm to displace the pectoralis major muscle, and extending the skin incision slightly. An incision over the lowest rib to be removed, extending to both sides of the original incision, will aid in the further steps of the operation and will provide for more posterior drainage at the conclusion of the operation. By separating the periosteum from the bone with a sharp raspatory, each rib can be stripped of its soft tissues easily, these then strongly retracted by an assistant, and the rib divided as far posteriorly as the angle and anteriorly as the junction of the bone and cartilage. The greater part of the chest wall is then free of the ribs. If it is then soft and flexible it sinks in spontaneously and the empyemic cavity disappears. If it is rigid, the costal pleura may be removed and if necessary transverse incisions in the chest wall made.

Bayer operated successfully on 2 chronic cases by this method after

the simpler operations had repeatedly failed. In both he sutured only the upper angle of the wound and drained with a tube at the posterior end of the secondary incision. An abundant layer of gauze was laid over the approximated edges of the flaps of soft tissues and held in place by a bandage. In the second case, because of the rigidity of the ribless wall, it was necessary to make a curved incision in it before it would apply itself to the diaphragm and retracted lung. The especial advantages of this operation are that it can be done quickly without serious loss of blood, and that the resulting disfigurement is not great.

Drainage of the Prevesical Space through the Perineum in Suprapubic Cystotomy.—BELFIELD (*Annals of Surgery*, 1906, xlv, 101) says that while suprapubic cystotomy admittedly affords the best access for intravesical operations, the difficulty in drainage of the urine against gravity, when primary union is not obtained or attempted, leads to leakage into and infection of the prevesical space, commonly, in spite of the many devices to prevent it. The mortality of the suprapubic operation in elderly people is distinctly greater than that of perineal incisions for the same purpose, notably prostatectomy. He suggests draining the prevesical space into the perineum in the following manner: When the operator is ready to close the wound, the membranous urethra is opened on a grooved staff, the gorget introduced, and the staff withdrawn. A small trocar and cannula is passed from above along the anterior surface of the bladder and prostate into the groove of the gorget. The trocar being removed, a few strands of silkworm-gut are passed through the cannula along the gorget, out through the perineal wound. A small rubber tube may be attached and drawn through by the threads. A large, soft catheter, with multiple perforations having been introduced into the bladder for perineal drainage, the suprapubic incision. bladder, and abdominal wall are closed completely, except where the threads protrude, the anterior bladder wall being anchored near the recti muscles. In 9 of 11 cases the wound entirely healed within two weeks. In the remaining 2, oozing blood was allowed to block the perineal opening, making it necessary to reopen the wound for the insertion of a larger drain. Greater care in checking oozing with formalin gelatin should prevent this mishap.

The Treatment of Fistulæ.—MERTENS (*Zentralbl. f. Chir.*, 1906, xxxiii, 1345) says that the usual treatment of fistulæ, curetting away the anemic and indolent granulations with a sharp spoon and producing a fresh healing surface, has the two disadvantages that it requires narcosis and leaves a larger wound. Mertens advises the employment of dry cupping to produce a freshening and hyperemia of the granulations, and says the more active the hyperemia produced the more quickly will the fistula close. He first sets the cupping glass over the mouth of the fistula with firm pressure so as to obtain the greatest suction. The effect of the sudden forcible filling of the bloodvessels is to rupture the torpid granulations, and to produce a more or less fresh wound surface with an escape of blood from the fistula. This suction is continued for about three-quarters of an hour. The bleeding stops gradually and serum takes its place. This procedure is repeated on the next and on the

third day, when it may be stopped. Healing of the fistula usually occurs in about a week. Mertens admits that these fistulæ may heal spontaneously if sufficient time is permitted, but holds that when a fistula has existed seven weeks and closes under this treatment in seven days, the result should be attributed to the treatment. If it does not show an inclination to heal in a few days from this treatment there is probably a foreign body, as a necrosed bone, at fault, and this must be removed. He says that post-traumatic and postoperative fistulæ (not specific) heal by this treatment in a short time. If one does not improve in a few days there is a clear indication for an early operation for the removal of a foreign body.

Imperforate Anus; Congenital Obliteration of the Duodenum; Clubbed Hand.—HERMAN (*Jour. de chir. et annales de la Soc. Belge de Chir.*, 1906, vi, 438) reports an interesting case in which the above conditions were present. The child died three hours after a perineal operation, by which the rectal pouch was reached and the edges of the opening in the bowel were sutured to the edges of the perineal wound. The autopsy revealed an enormous distention of the stomach, which at first sight seemed to be double. The lower portion of the distended mass, however, was made up of duodenum; but both portions were filled with meconium. There was atresia of the small intestine, cecum, ascending and a part of the transverse colon; although their general conformation was normal. The appendix, of normal length, contained only a little meconium; the small intestine, cecum, and part of the colon were absolutely empty. The duodenum, beyond the dilatation of the portion already referred to, did not appear to be permeable. A part of the transverse, the descending, and the sigmoid portions of the colon contained a rather large quantity of meconium. At the end of the dilatation of the duodenum there was a true valve preventing the passage of liquids into the intestine. This case shows how the success of an operation for imperforate anus may be compromised by the existence of other anomalies incompatible with existence. Hobson, Champneys, Bundeau, and Kirmisson have reported similar cases.

The Omentum and its Functions.—DICKINSON (*Annals of Surgery*, 1906, xliv, 652) says that the numerous bloodvessels and lax tissues of the omentum allow of storage of blood when the general tension is high. By venous anastomosis through adhesions, local congestion may be relieved. Through its large surface freely exposed to surrounding parts in motion, the omentum is a rapid absorber of fluids by the blood stream. By the lymph stream it is a free carrier of white blood corpuscles, encapsulating solid particles. Through its cohesive tendency apertures in the abdomen into which the omentum has been forced by intra-abdominal pressure become more or less completely closed. Through its ready tendency to lymph formation and local proliferation, it becomes attached to infected parts, which are walled off, subsequently to be absorbed by phagocytic action, the peritoneal cavity being thereby protected. The majority of phagocytes extruded into the peritoneum for its protection come through the omentum largely from the general circulation, but in part from the tissues therein existing; subsequently

to be attached to the surface of this tissue, taken into the lymph stream, and subjected to the cytolytic influences existing there. Lack of development of the omentum, or loss through operation, renders one less resistant to peritoneal invasion. Hemolymph glands of the splenic type existing in its base supplement the spleen if the latter be removed or its functions interfered with.

Vasovesiculectomy in Cases of Genital Tuberculosis.—BAUDET and KINDIRDJY (*Revue de Chir.*, 1906, xxvi, 749) believe that this operation is especially necessary: when there is a urinary fistula, produced and maintained by the vesicular tuberculosis; when there is rectal obstruction; when the urinary disturbances are determined by this vesiculitis and are not dependent on a cystitis; when the patients for some time under observation and treatment, medical or a previous castration, have vesicles that continue to increase in size; finally, when there exist well-marked lesions, distinctly appreciable, along the whole length of the deferential canal. Moreover, vesiculectomy appears to be the operation of choice, when one or both vesicles are very large. When the lesions of the deferential canal and of the seminal vesicles are not marked the writers do not advise vasovesiculectomy. In such a condition, according to Roux, this operation should be done to prevent the later necessity for epididymectomies and castrations, to prevent tuberculous infection of the other testicle, and to prevent a general tuberculosis. In the opinion of the authors these indications are purely theoretical, which the operation does not always fulfil. These cases appear to be especially amenable to the more economic operations on the testicle and epididymis and to medical treatment. In spite of this restriction the operative indications are very numerous and precise. There is already a strong tendency toward the operation in England, America, Switzerland, and France. Its use will undoubtedly be somewhat restrained, but Baudet and Kindirdjy are convinced that it will become classic, as has castration, in spite of the condemnation of Velpeau, and since then epididymectomies.

Operative Indications in Old Traumatisms of the Head.—TIXIER (*Revue de Chir.*, 1906, xxvi, 861) says that the clinical manifestations consecutive to old injuries of the head are dependent upon a great variety of anatomical lesions, such as hypertrophy or splintering of the bone, epidural effusions of blood or serum, depressions, thickenings, or adhesions of the meninges, as well as changes in the cerebral substance. Microscopic alterations in the nervous substance also play a manifest role, as is shown by the experimental and clinical evidence. The work of Horsley has shown that excessive pressure from cerebrospinal fluid may produce exaggerated cerebrospinal excitation. Withdrawal of the fluid was followed in most cases by a disappearance or attenuation of the symptoms. Tixier thinks that an excess of cerebrospinal fluid ought to be considered in some of the more important anatomical lesions. In the case of an injury to the cranium, judged unimportant because of the lack of superficial evidence of an important lesion, but which later develops a series of complications, it is well to take into account the possibility of a previous injury to the cranium. The symptomatic indications of old traumatism are precise when the signs of localization

are directly in accord with the relicts of an old fracture or contusion. The signs of Jacksonian epilepsy are the signal symptoms. Headache resisting all palliative treatment may acquire such an intensity as to make it an operative indication of the first order. There do not exist any absolute surgical contraindications. Lumbar puncture, in all cases with symptoms consecutive to old cranial injury, has an incontestible diagnostic value. It can also attenuate or cause to disappear the cerebral symptoms depending upon an excess of intracranial tension, such as the vertigoes, headache, œdema of the papilla, epileptiform excesses. This operation in some cases may be followed by a cure. In the case of recurrence or of failure, complete or relative, one should not hesitate to perform a second operation. Successive operations have great importance, since the observations of patients definitely cured only after the third operation are not rare in the literature.

The Radiotherapy of Hypertrophied Prostate.—TANSART and FLEIG (*Annales des maladies des organes genito-urinaires*, 1906, xxiv, 1841) believe that in hypertrophy of the prostate distinct atrophy results from radiotherapy. Since the perineal region, which is the better for exposure to the rays, is a sensitive part, the exposure should be prudently conducted. The strength should never exceed five units of Holzknecht, the rays marking seven on the radiochronometer of Benoist. Tansart and Fleig prefer prolonged exposures, at intervals of fifteen to twenty days, with rays of moderate intensity, rather than heavy exposures at short intervals. They continue the treatment until the complete disappearance of all physical and functional troubles. Radiotherapy is particularly indicated in: prostatics who have not attained the period of retention; young prostatics; those who, having attained retention, can only urinate with the catheter, and are not obliged—from their social position—to obtain a rapid cure; those with infected bladder; and those with renal lesions.

The Technique of Operations on the Head and Neck.—CRILE (*Annals of Surgery*, 1906, xliv, 842) restricts himself to a consideration of the control of hemorrhage, and the plan and extent of dissection in malignant tumors. Four distinct methods are considered in connection with arterial hemorrhage. The head-up posture by diminishing the arterial flow is helpful, but with the patient under full anesthesia is attended with the danger of sudden and not easily controlled cerebral anemia, because of the circulation not being sufficiently under control. If full surgical anesthesia is not employed, precise dissection is hampered. The literature shows between 2 and 3 per cent. mortality from cerebral anemia, due to ligation of the external carotid artery; while the exposure and tying of the vessel requires dangerous handling of malignant tissue. The laborious task of picking up a large number of vessels from point to point by artery forceps requires an increased length of time and becomes a decided factor in the production of shock. The fourth method includes the temporary closure of the common carotid, in the head-up position, the catching of each vessel with forceps as it is cut, and the application of the pneumatic suit to prevent cerebral anemia. Air embolism is another distinct danger from the head-up position, but is avoided by accurate dissection, which is greatly favored by the

clearer field afforded by the posture and arterial occlusion. Of 18 cases of excision of the Gasserian ganglion, in the last 8 the factor of hemorrhage from the standpoint of its constitutional effect, and almost equally so from the standpoint of the obscuring of the field of operation, has been literally obviated. Great advantage is experienced by this method in operations on cleft palate, excision of the tongue or of the tonsil for malignant disease, anesthesia being carried out by tubage of the pharynx, the method of performing which Crile has described in a previous paper. In the earliest stage of malignant disease local excision may be sufficient; but it is safer always to remove the lymphatic-bearing tissue immediately draining the focus. If the lymph glands are once involved, the whole group of glands and gland-bearing tissue of that side of the neck must be sacrificed, and the key to the situation is the internal jugular vein, which is readily compensated for, physiologically. This paper is based upon experimental researches which have been heretofore published, and a clinical experience in 734 operations on the head and neck.

THERAPEUTICS.

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The Influence of the Roentgen Rays upon the Blood and the Blood-making Organs.—BARJON (*Médecine moderne*, 1906, No. 31, p. 245) considers that the *x*-rays are potent only in the chronic type of leukemia; they are useless in the acute and subacute types of the disease. In favorable instances their effects are marked; all the symptoms and physical signs diminish and finally disappear. Unfortunately the cure is often merely temporary, for recurrences are frequent. In other patients the improvement is limited to certain symptoms; the splenic enlargement persists, the polynuclear leukocytes do not return to the normal number; the arrest of the disease may last for several months; but the time comes when, in spite of the improvement, death occurs, the evolution of the morbid process having continued even though the essential symptoms have disappeared. The prognosis depends upon the patient's general condition, the hemoglobin percentage, and the temperature. It is essential that the number of red cells should be kept as nearly normal as possible. The technique of the application of the rays is as follows: They are applied chiefly to the splenic region; but the sternum, the extremities of the long bones, and the lymph glands are not to be

neglected. The exposures should be in series intermitted by periods of rest. The patients so far treated have not been followed sufficiently long for it to be possible to make definite statements as to the efficiency of the treatment; but we are able to assert that no other means affords results in any way comparable. The operator should always be skilled both in radiotherapy and hematology.

The Roentgen Rays in Chronic Bronchitis.—T. SCHILLING (*Semaine médicale*, 1906, No. 38, p. 451) has noticed in a patient affected with bronchitis who had been submitted to the *x*-rays a complete cessation of expectoration during the evening of the day of the exposure. The other symptoms also were ameliorated, and after about five weeks the dyspnœa had wholly disappeared and the patient expectorated less in a week than he had previously raised in a day. In a number of others systematic employment of the rays led to the following results: Seven bronchitic patients were treated, and it was found that exposures of from six to fifteen minutes sufficed to produce the desired result. Both sides of the chest were exposed, save when the bronchitis was unilateral. Schilling is able to state that in chronic bronchitis the good effects of radiotherapy are almost immediately evident, and persist for as long as two or three months in some patients.

Electricity in Circulatory Disorders.—L. RAAB (*Münch. med. Woch.*, 1906, Nos. 29 and 30, pp. 1412 and 1440) has employed electric baths in various circulatory affections and has studied their influence upon physical signs and symptoms. Baths of the galvanic current exercise a distinct effect upon the action of the heart and cause the symptoms of fatigue to disappear rapidly. To this effect is added a functional modification of the vascular system, increasing arterial pressure to its maximum. There are, however, conditions aside from acute febrile diseases and arterial lesions, in which electricity fails completely. Bad effects following the baths are rare; but in hysterical patients, tremors and pain may result from the action of the current. Elevated blood pressure, in Raab's opinion, should preclude the exclusive use of the alternating current, and he states that the itching that this current may cause when the alternations are slow (5000) may be avoided if the interruptions are increased (14,000). He considers the electric bath superior to the tepid bath in patients who react poorly to cold, and in certain respects it is superior to carbon dioxide gas baths, although these latter possess certain distinct advantages.

Serum Therapy in Anthrax and Plague.—N. D'ESTE EMERY (*The Practitioner*, 1906, lxxvii, 597) states that several sera are now obtained which appear to be of decided value in the treatment of anthrax. Of these the best known is Sclavo's, which is obtained from the sheep or ass. The process consists in first immunizing the animals by Pasteur's method of the two vaccines, and following this by repeated large injections of virulent cultures mixed with gelatin, which seems to obviate abscess formation. The serum has been largely used on the Continent and several cures have been reported in England. The initial dose is 5 to 10 drams repeated in twenty-four hours if necessary, or four or five

5 dram doses may be employed. Sobernheim's method of immunization is somewhat different and consists in injecting the animal with a mixture of bacilli and anthrax serum. This method is supposed to give the rapid immunization of the passive method and at the same time the more lasting immunity obtained by vaccination. The serum has been mainly used in animals, but extremely good results have been obtained in man; the usual dose is 5 drams and intravenous injection is advisable. Both Sclavo's serum and Sobernheim's method may be followed by rise in temperature and sweating, after which improvement takes place within twenty-four hours. The serum treatment of plague, according to the latest reports from India, is not affording the good results which might be hoped. The best serum appears to be Terni's, which has given a small reduction in case mortality, a relief of symptoms, and a lengthening duration of life in fatal cases. Duprat has treated, with the Roux-Yersin serum, twenty-nine patients with only four deaths; the doses were large—6 to 9 drams; when smaller amounts of serum were used the results were less satisfactory. Hill has found the Yersin serum valuable in the recent Natal epidemic. Most observers advise large doses and Calmette advises intravenous injection.

Galvanism in Exophthalmic Goitre.—A. D. Rockwell (*New York Med. Jour.*, 1906, lxxxiv, p. 873) considers that while much has been accomplished by surgery and by antitoxin treatment in this intractable affection, the results from galvanic treatment are quite as good, if not better, than those obtained by other means. The disadvantage of electricity is its slow action; on the other hand, it is not dangerous and might profitably be employed in connection with antitoxin. The dose must be massive, that is to say, the current should be carried up to the limit of endurance, but not high enough to injure the skin.

Methylthionine Hydrochloride in Inoperable Cancer.—Jacobi (*Jour. Amer. Med. Assoc.*, 1906, xlvii, 1545) states that this drug has rendered him much good service in from 120 to 150 cases during the last fifteen years. He prescribes the agent in pills, in small doses, 2 grains a day slowly increased to 6 grains. He considers that larger dosage is not required. The pills are made up with belladonna extract, $\frac{1}{4}$ grain daily, to relieve any dysuria which may occur. Frequently arsenic trioxide, $\frac{1}{60}$ to $\frac{1}{30}$ grain, three times daily, is added to the pill; strychnine or nux vomica extract may also be added if indicated. While Jacobi makes no claim that methylthionine hydrochloride possesses any curative action, he feels sure that in instances of inoperable cancer it will do a great deal of good and that by its use many patients have been kept alive and even in a condition to work for from two to eight years longer than would otherwise have been the case.

The Treatment of Chlorosis.—H. Rosin (*Die Therapie der Gegenwart*, 1906, No. 7, p. 298) advises in this affection baths at 104° F., three times weekly, at first of ten minutes' duration, later gradually increased to twenty minutes. The same temperature should be maintained throughout the procedure; an ice-cap should be kept upon the patient's head and at the end of the bath she receives a cold douche lasting

a few seconds. She is hen dried with a towel and allowed to rest for an hour. At first the baths cause an unpleasant nervousness, which disappears after three or four applications of the treatment; at this time a general improvement is noted, and recovery is said to be evident by the time twelve baths have been taken. If the chlorosis is a manifestation of organic disease, such as tuberculosis or nephritis, the treatment naturally is ineffective. In instances of true chlorosis, recurrences which may take place should be treated in the same manner as the original attack.

Medicinal Treatment of Gastric Displacements.—FENWICK (*Edinburgh Med. Jour.*, 1906, xx, 395) states that in uncomplicated instances drugs are seldom of much value and the treatment is chiefly symptomatic. For anorexia, nitrohydrochloric or phosphoric acid, combined with a bitter infusion, may be given between meals. If extreme weakness is present, tonics such as strychnine, nux vomica, or cinchona may be prescribed; in neurasthenic patients, cod-liver oil, the compound syrup of hypophosphites, elixir of phosphorus, or sodium formate may prove beneficial. Pain after eating and flatulence may be relieved by compound bismuth mixture, with or without morphine. Preparations of pancreatin, pepsin, or peptenzyme may aid the process of digestion. The presence of myasthenia requires the addition of phenol to the bismuth mixture, and in instances complicated by colitis full doses of bismuth salicylate, cyllin, or guaiacol should be employed. The selection of an aperient is important. As a rule, severe purgatives are to be avoided and reliance is to be placed in small doses of cascara and euonymin combined, if necessary, with belladonna and rhubarb; a confection of guaiacum, senna, and ginger may be employed to advantage. If the colitis is associated with constipation nothing is so effectual as a small dose of castor oil each morning before breakfast, but if severe neurasthenia exists purgatives must be omitted and a daily movement must be secured by soapsuds enemas or glycerin injections. Carlsbad and other salts are indicated in myasthenia with stagnation of food, since they effect a form of internal lavage, sweeping the fermenting gastric contents into the intestine. In other respects gastroptosis is to be treated, as far as medicines are concerned, identically with chronic gastritis and gastric atony.

The Treatment of Rectal Constipation.—According to H. STRAUSS (*Therap. Monats.*, 1906, No. 8, p. 373) stasis of the feces in the rectal ampulla is responsible for 10 per cent. of the instances of constipation. It is the result of a loss of the reflex which causes the expulsion of the fecal masses when these have reached the rectum, and this is chiefly caused by a disinclination on the part of the patient to go to stool, perhaps on account of the pain which is induced by the act, as in gonorrhœal prostatitis, uterine disease, etc. Treatment consists of local measures and in regular visitation of the stool, even when inclination is not present, at a certain time each day. Faradism, vibratory massage, and cold irrigations are useful adjuvants. In addition, the employment of a specially constructed syringe, by means of which three ounces of oil may be injected into the rectum, may be prescribed. When the scybalæ are so hard that they

provoke a spasm of the sphincter when an attempt at passage is made, the patient may be advised to attempt defecation in a vessel containing steaming hot water.

Strontium Lactate in Hemophilia.—J. B. NIAS (*Semaine médicale*, 1906, No. 36, p. 428) has obtained an excellent result in a hemophilic patient in whom calcium lactate and the administration of thymus gland had proved conspicuous failures, by prescribing strontium lactate. The dose given was 15 grains, which amount reduced in about an hour the coagulation time of the blood by a third. Double dosage produced no better effect. The result was not permanent and the patient was furnished with powders of the drug to be taken whenever hemorrhage occurred. By this means the patient's bleeding could be stopped within twelve hours when previously it would persist for several days.

The Roentgen Rays in Neuritis.—J. H. CUMROE, (*New York Med. Jour.*, 1906, lxxxiv, 740) reports six instances of neuritis in which radiotherapy has been employed, and from them draws the following preliminary conclusions: (1) The *x*-rays should be employed in neuritis only after all other judicious methods of therapy have failed. (2) The exposure should be directed over as wide an area as may be safe, and, at first, exposures should be frequently repeated. (3) The strength of the current and the duration of the exposures should, as a rule, be in direct ratio to the approximate distance of the affected nerve structures from the overlying skin. Idiosyncrasies should be carefully sought. (4) Relief, if obtained, usually makes its appearance early in the treatment. (5) Obstinate cases should receive "tonic" treatment with a medium tube for some time after apparent cure, so as to assure permanency. (6) Postoperative treatment in nerve resections is highly recommended.

The Treatment of Simple Insomnia.—LEMOINE (*Jour. de méd. de Paris*, 1906, No. 39, 423) advises patients affected with this condition to take at evening a bath to which an infusion of linden leaves has been added. This should be of about body temperature and of a duration of three-quarters of an hour. The bath is followed by a light meal without beer, wine, or coffee. Three hours later the patient retires after taking a cup of hot infusion of linden leaves to which about two teaspoonfuls of the following mixture has been added: Potassium bromide, 5 parts; hydrated chloral, 10 parts; syrup of lactucarium, 20 parts; cherry-laurel water, 10 parts; lettuce-water, 120 parts; for this may be substituted 12 grains of sulphonal combined with 4 grains of sodium bicarbonate, or 3 grains of chloralose. These doses may be repeated later if necessary. If the insomnia is associated with nervousness or anxiety heroin may be given as follows: Heroin hydrochloride, 0.003 to 0.008 parts; cherry-laurel water, 10 parts; linden-water, 50 parts. Dose two teaspoonfuls every hour. If there is danger of the patient becoming habituated to the drug paraldehyde should be substituted.

PEDIATRICS.

UNDER THE CHARGE OF

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The Routine Treatment of Scarlet Fever with Chloral Hydrate.—B. FRANKLIN ROYER (*Penna. Med. Jour.*, January, 1907, p. 286) describes the results of a study of the kidney condition of 800 cases of scarlet fever, treated with routine doses of chloral hydrate, as compared with the renal conditions observed in 756 cases having the usual remedies. The study was made in the wards of the Philadelphia Municipal Hospital, beginning in 1904, with the object of determining the value of chloral hydrate, which was advocated in 1896 by Dr. James C. Wilson. Dr. Wilson believed that he had secured an increased diuresis thirty-six to forty-eight hours after the administration of chloral had been begun. He thought that in some way chloral protects the functionating part of the kidney tissues, that the nervous symptoms were greatly modified, that the itching was allayed, and that the patient was made more comfortable. A few weeks' trial convinced the hospital staff that Dr. Wilson's claims were for the most part easily proved and that chloral hydrate did appear to be the most useful remedy yet advocated in the treatment of scarlatina for making the patient more comfortable, ameliorating the nervous symptoms, and controlling the itching. The effect upon the circulation was next carefully studied. After treating nearly 1000 patients with doses of sufficient size to produce light somnolence, it was decided that chloral did not materially depress the circulation, and in no case did the drug act clinically as a serious depressant. At first the drug was given to patients greatly prostrated on admission and discontinued after a few doses were given because of prejudice against it. After a larger experience it was rarely discontinued, no matter what the degree of depression might be. One claim was not confirmed, viz., that of early diuresis. An increased flow of urine twenty-four to forty-eight hours after admission undoubtedly does occur, but the same increase was noted in patients treated by other remedies. This Royer attributes to better nursing, the systematic use of water in definite quantities, insisted upon whether the patient wants it or not, and the greater ease with which liquids are swallowed as the angina subsides.

The special study to which this paper is devoted relates to the kidney condition met with in the postfebrile period: 800 cases were treated with routine doses of chloral in sufficient quantities to produce light somnolence, and continued in the same dose for five or six days after the fever subsided. A series of 756 patients treated by the usual remedies (a few of them perhaps having a dose of chloral to quiet extreme restlessness at night, most of them having no chloral at any time) was analyzed in exactly the same way. All histories were excluded in both series in which other infectious disease or other serious illness was

combined with scarlatina; 3 patients died in the chloral group, and 4 in the usual remedy group. In the febrile period no material difference was found in the number of those having either mild, transient, or severe nephritis. In the postfebrile period the percentage of those having postfebrile albuminuria was 4.25 per cent. in the chloral cases as against 5.68 per cent. in the series treated without chloral; a transient postfebrile nephritis occurred in 3.5 per cent. as against 5.29 per cent. without chloral; and severe postfebrile nephritis occurred in 2 per cent. as against 2.38 per cent. without chloral. The total of all forms of postfebrile nephritis was 5.5 per cent. in those having chloral as against 7.76 per cent., or an apparent total saving of 2.17 per cent. of postfebrile nephritis. A separate classification of patients to whom antitoxin had been given apparently demonstrates that nephritis is a little more frequent in those patients having antitoxin. Another table shows the day of the disease when nephritis may be expected. The greatest danger is shown to be the period from the twentieth to the thirty-second day, or the third week and the early part of the fourth week. Royer concludes that this study would seem to justify the more extended use of chloral in the treatment of scarlet fever, and a more detailed study as to how it acts on the kidney itself.

Lobar Pneumonia as a Complication of Diphtheria.—The occurrence of lobar pneumonia in the course of diphtheria has always been regarded as an exceptional event. The earlier writers, such as Barthez and Rilliet and Cadet de Gassicourt, stated that the pneumonia which complicated diphtheria was always lobular in character. Sanné is the only authority who has held that this condition is other than a rarity. He has found it in 48, or 3.2 per cent., of his 1500 cases of diphtheria. most of these occurring in laryngeal cases, and only 4 recovered, Recent writers are agreed as to the rarity of secondary lobar pneumonia in diphtheria. J. D. Rolleston (*Brit. Jour. Children's Diseases*, December, 1906, p. 536) presents a paper based upon his observations made on 1000 consecutive cases of diphtheria under his care at the Grove Hospital (London) during the past four years. Lobar pneumonia occurred in only 7 cases (0.7 per cent.). All the patients were children, their ages ranging from about two years to seven years. As 266 of the total number were above the age of seven years, childhood appears to be a predisposing factor. Three of the patients were males, 4 females. Only 3 were cases of laryngeal diphtheria, 2 requiring tracheotomy; of the remainder 3 were of a severe faucial type, and 1, the most typical, was a mild faucial case. It is noteworthy that in 15 cases of bronchopneumonia that occurred in the 1000 cases, 9, or 60 percent. were found in laryngeal cases, 7 of which were tracheotomized. With one exception, occurring in the ninth week, all the cases arose within the first ten days of the disease; in 3 cases the pneumonia developing before the throat became clean; in 2 the membrane disappeared from the throat on the same day the pneumonia began. In the remaining case the throat had already been clean six days.

In 3 the onset was abrupt, occurring after the subsidence of the initial pyrexia; in the remaining 4 the initial pyrexia had not yet subsided, but was increased by the supervention of the pulmonary condition.

The pneumonic process showed a predilection for the right lung, especially for the lower lobe. In 5 the right lower lobe alone was affected, in 1 the lower lobes of both lungs, and in 1 the right upper lobe alone.

Of interest in the diagnosis is the fact that the initial pyrexia of diphtheria is usually of short duration, and tends rapidly to fall after the injection of antitoxin. A sudden rise or an exacerbation of the initial pyrexia should therefore draw special attention to the condition of the lungs. According to v. Jürgensen the diagnosis of lobar pneumonia can only be settled by the absence of a widespread capillary bronchitis.

The more favorable prognosis of lobar pneumonia as compared with bronchopneumonia is illustrated in Rolleston's cases by the fact that whereas none of the 7 cases proved fatal, only 3 of the 15 cases of bronchopneumonia among the 1000 cases of diphtheria recovered—a mortality of 80 per cent.

The rarity of lobar pneumonia in diphtheria suggests that its occurrence is but a fortuitous one, Baginsky in particular regarding it as entirely accidental. Against this view should be weighed its predilection for children and its occurrence at an early stage of the disease. In addition to the characteristics already noted it may be stated that such cases resemble the primary lobar pneumonia of children in being atypical in the following respects: Absence of expectoration and of marked respiratory trouble, an occasionally remittent or even intermittent pyrexia, the frequent occurrence of lysis, its relative benignity, and absence of any sequels except empyema.

A Large Retroperitoneal Dermoid Cyst in an Infant.—Raymond Johnson (*Brit. Jour. Children's Diseases*, December, 1906, p. 549) reports a case of a child, aged two years and nine months, with a large, elastic tumor in the left half of the abdomen, presenting characteristics similar to those met in a sarcoma of the kidney. The lumbar spine showed a well-marked lateral curvature to the right, with rotation of the vertebræ, and in the left loin were two small fluctuating swellings not apparently connected with the tumor in the abdomen. Before operation the case was regarded as probably tuberculous disease of the spine, with lumbar and large retroperitoneal chronic abscesses. An exploratory incision in the loin revealed the true nature of the case. Part of a small cyst removed from the posterior part of the tumor presented the naked eye and microscopic characters of a dermoid tumor.

OBSTETRICS.

UNDER THE CHARGE OF

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Induction of Premature Labor and Accouchement Force.—Williams (*Surg., Gyn., and Obst.*, September, 1906) in 5000 labors in the obstetrical department in the Johns Hopkins Hospital found it necessary

to induce premature labor in 11, and to practise accouchement forcé in 100 cases. Labor was induced by the introduction of a bougie for cardiac lesions, pre-eclamptic toxemia, retention of dead fœtus, hydramnios, infection, and overdevelopment of the child. All the patients recovered. The cervix was uninjured in 9, and slightly torn in 2 cases. In 83 cases the cervix was dilated manually by Harris' method. This was done for eclampsia in 33 cases, toxemia in 7, placenta prævia in 12, and danger to mother or child during labor in 31. In eclampsia 2 patients died as the direct result of the operation, 1 from infection, and 1 from incomplete rupture of the uterus. In these 33 cases the cervix was uninjured in 11, slightly torn in 3, and deeply torn in 19; and in 6 of the latter the laceration was so deep as to give rise to serious hemorrhage and require immediate repair. In 7 cases of toxemia threatening eclampsia, it was effected by manual dilatation, with 2 deaths, 1 from toxemia, and 1 from incomplete rupture of the uterus, due to the operation. In placenta prævia the same operation was performed in 12 cases; and 1 patient died from hemor hage following incomplete rupture of the uterus caused by the operation. In 31 patients delivered by manual dilatation, because of some danger arising during labor, 1 maternal death occurred, caused by partial intestinal obstruction and thrombosis of the vessels of the left leg, originating during pregnancy. The mortality rate of the operation was 4.82 per cent. The cervix was deeply lacerated in 39.71 per cent. In 17 per cent. it was so badly torn as to cause profuse hemorrhage, and require immediate repair. The results were much worse in placenta prævia than in any other condition. In 15 cases dilatation was effected by the use of de Ribes' bag. All of the mothers recovered, and the cervix was deeply torn in 6 cases. In 2 of these, hemorrhage was so great as to require immediate repair. There were 2 cases of vaginal Cesarean section, one for eclampsia, and one for toxemia with twin pregnancy. One of these patients died, partly from hemorrhage and partly from intoxication. Technically, the operation was successful. In reviewing these methods, the use of the bougie is evidently safest, but it is uncertain and tedious in many cases. Manual dilatation is difficult and dangerous when the cervix is intact and the internal os not obliterated. If the cervical canal is obliterated and the external os offers little resistance, manual dilatation is comparatively safe. In placenta prævia manual dilatation is extremely dangerous, as deep tears occur in 50 per cent. of cases, and most of these were complicated by hemorrhage and required suture. The use of the dilating bag seems indicated in placenta previa when haste is not essential, and when the cervix is not extremely rigid. Vaginal Cesarean section is not adapted for general use in private practice and requires special surgical training. Very large specula should be employed, and usually both anterior and posterior incisions may be made. The uterus should be packed after delivery to guard against relaxation. In obstetrical hospitals this operation will be found successful. In general, the induction of premature labor was not adopted for moderate pelvic contraction. Such patients were allowed to go to term, and labor was terminated by forceps, pubiotomy, or Cesarean section, as indicated in the individual case. When haste is not imperative, the method of the bougie may be employed in all other conditions. In eclampsia, if the circumstances are favorable, vaginal Cesarean section should be useful

when the cervix is undilated and resistant. When the cervix is obliterated and the external os only remains, manual dilatation is indicated. The Bossi dilator was not employed, and does not seem indicated. Vaginal Cesarean section is safer when the cervix is not softened, and when the cervix is obliterated manual dilatation may be performed. In placenta prævia the ideal method of treatment seems to lie in the use of the dilating bag, or bipolar version, with very gradual extraction. When danger arises to mother or child during labor, the operator should hesitate to have recourse to accouchement forcé. The dangers of this procedure may be greater than the danger which threatens the mother.

Eclampsia Four Weeks after the Birth of the Child.—VAQUEZ (*Zentralbl. f. Gyn.*, 1906, No. 41) reports the case of a patient who, four weeks after a normal labor, came to the hospital complaining of weakness, headache, and slight œdema of the legs. The patient's mother had had eclampsia. On examination, the pulse tension was high, and the heart sounds strongly accentuated. The urine contained a considerable percentage of albumin. In the twenty-four hours following, the patient had 17 typical eclamptic convulsions, the temperature rising to 103.5° F. After removing considerable blood from the arm, the convulsions ceased and did not recur. The blood pressure slowly grew less and the secretion of urine increased. After the fourth day from the begining of the eclampsia the patient rapidly improved.

Criteria of Full-term Birth.—HOLZBACH (*Monats. f. Geb. u. Gyn.*, 1906, xxiv, Heft 4) contributes a paper in which he describes those signs from which the full term development of a newborn child may be estimated. In reviewing the literature on the subject, he finds that the length of gestation has been considered by some important in estimating the full term development of the child. As gestation differs in different patients, it is impossible to form a definite opinion concerning the length of a gestation which may produce a fully developed child. Regarding the length of the child, Issmer has called attention to the fact that 61.8 per cent. of fully developed children in a considerable number, varied in length from 48 cm. to 50. n 31 premature children, Holzbach found three 48½ cm. long. We cannot assert that a child 50 cm. long is more completely developed than one 48 cm. long. The weight of full-term children differs so greatly that this cannot be taken as an absolute criterion. If the attempt is made to take the development of the finger-nails, the presence of lanugo, or the condition of the genital organs as indicating complete development, we find here that no one of these is absolutely reliable. In 30 premature children, Holzbach found 18 whose finger-nails were well developed and firm. The cartilages of the ear and nose were well-developed in 42 per cent. In 17 per cent. of premature children lanugo was not present. This statement differs essentially from that of Herz, who, in 96 premature children, found lanugo on the face, the buttocks, and extremities in 1 each. The presence of comedones was observed in premature children in the majority of cases. As regards the condition of the genital organs, the labia were found fully developed in 48 per cent. of premature female

children. In 72 per cent. of male children the testicles were already in the canal or in the scrotum. The greater fontanelle varies so much in size that its condition cannot be taken as a means of determining the complete development of the infant. So far as the separation of the umbilical cord is concerned, the stump of the cord loosens earlier in premature children than in those at full term. Some deny this observation, and believe that no difference can be demonstrated between the two. As regards the weight of the placenta, it is unquestionably greater in full-term children than in the premature. Variations in weight of 300 or 400 grams between the placentæ of fully developed children were also observed.

Examination of the fœtal skeleton is also not conclusive, as children vary greatly in the degree of ossification at full term. The weight of the various fœtal organs, and the proportionate development of the child, are of assistance in estimating full development. Holzbach considers of especial value the relation between the circumference of the shoulders and the circumference of the fetal cranium. It is evident from this and other papers upon the subject that a child cannot be declared as fully developed because it possesses one of the conditions present at full term. It must show a considerable number of the various criteria of full development.

Pubiotomy and Induced Labor.—FEHLING (*Monats. f. Geb. u. Gyn.*, 1906, xxiv, Heft 4), from the statistics of the Strassburg clinic, believes that premature birth does not jeopardize the existence of the child after the first few weeks. Pubiotomy cannot be considered a substitute for induced labor. It should be selected for primiparæ with contracted pelves as a substitute for craniotomy; also for multiparæ who decline Cesarean section; and when complications arise in labor because of disproportion. Induced labor is especially successful among married patients who have lost one or two children in difficult birth.

The Indications for the Management of Labor in Contracted Pelvis.—PFANNESTIEL (*Monats. f. Geb. u. Gyn.*, 1906, xxiv, Heft 4) urges increased practise and adoption of induced labor in contrast with pubiotomy. and Cesarean section. When the pelvis is highly contracted, a woman should be sent to a hospital for treatment. In all these cases the effort should be to allow a natural attempt at parturition, giving the patient every assistance to complete the birth spontaneously. The forceps can seldom be used to advantage, especially in flat pelves. Version and extraction are dangerous in highly contracted pelves of symmetrical shape When the pelvic contraction is slight, the prognosis is slightly better, and is best in cases of simple flat pelves. In multiparæ with simple flat pelves prophylactic version gives good results. In primiparæ when the true conjugate is from 7 to 8.5 cm., induced labor is usually successful. When the pelvis is flattened only induced labor, with version, is useful. The use of the elastic dilating bag is also indicated in these cases. When the pelvis is symmetrically contracted, it is well to avoid the use of bags, and if necessary, to employ a bougie instead. When the pelvis is highly contracted, induced labor must be declined. If the child's life is to be saved, and the soft parts permit rapid dilatation, pubiotomy may be performed, but otherwise Cesarean section should be chosen.

GYNECOLOGY.

UNDER THE CHARGE OF

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Hemorrhage following Vaginal Hysterectomy.—MENDES DE LEON (*Zentralbl. f. Gyn.*, 1906, No. 40) reports a case in which clamps were used, which were removed at the end of twenty-four hours. On the seventh day such a profuse hemorrhage occurred that the patient became almost pulseless, but it was controlled by tamponade and she afterward made a good recovery. De Leon stated that this was the first case in which he had observed hemorrhage after the clamp-operation and attributed it to the opening of a large artery following the usual sloughing process. This was less likely to occur, he thought, when ligatures were used. In the discussion of this subject before the Dutch Gynecological Society, Stratz said that he had abandoned the use of clamps in vaginal hysterectomy because the patient had more pain than when ligatures were applied, the operation was less clear and exact, and there was more danger of secondary hemorhage. He was accustomed to closesthe peritoneum. He generally used from twelve to fourteen ligature , but the operation seldom consumed more than five or ten minutes more than the clamp operation.

Intra-abdominal Shortening of the Round Ligaments.—SPERLING (*Ztsch. f. Gyn.*, November 7, 1906, p. 206) commends this operation highly for the following reasons: (1) Freedom from danger. (2) Infrequency of recurrence, especially after parturition. (3) Avoidance of the risk of interruption of pregnancy. (4) The eliminating of subsequent dysmenorrhœa. (5) Avoidance of adhesions and consequent intestinal obstruction. (6) The danger of hernia is lessened by employing the transverse incision. (7) Adhesions overlooked during the examination are discovered and broken up. (8) Subsequent conception is rendered more probable. (9) There is less danger of displacing the tubes and thus forming the occurrence of ectopic gestation. (10) The uterus is more likely to be retained in its normal position in the pelvis. In general Sterling prefers intraperitoneal shortening of the ligaments to vaginal fixation or Alexander's operation.

Drainage of the Peritoneal Cavity.—D'ERCHIA (*Rassegna di ost. e gin; Zentralbl. f. Gyn.*, 1906, No. 40) distinguishes peritoneal from retroperitoneal drainage, meaning by the latter term that the peritoneum is sutured over the gauge drain. He also refers to "prophylactic" and "curative" drainage. He believes that in complicated cases drainage should reduce the mortality from 20 to 3 or 4 per cent. A series of seventy-two cases is appended in which abdominal drainage with gauge was employed in eleven, and vaginal in forty-seven. (It is interesting

to note the unwavering faith of the writer in a method which is fast becoming obsolete. Most surgeons now regard drainage as rather an unfortunate necessity and resort to it only when absolutely necessary. It is a question if gauze is not really used for tamponade, rather than for its capillary action—H. C. C.)

Examination of the Stomach in Pelvic Troubles.—WINKLER (*Berl. klin. Woch.*, 1906, No. 33) reports forty-one cases in which he examined the stomach contents. In only 29.9 per cent. was the secreting function normal. Hence, the deduction that the gastric symptoms accompanying uterine displacements, pelvic tumors, etc., are mainly due to disturbances of the secretory and motor functions. Gastroptosis was noted in eighteen out of thirty-one cases.

Winkler concludes that hyperchlorhydria is common in connection with pelvic troubles, and that treatment directed to the latter alone has little effect on the gastric condition.

Aspirin in Gynecology.—CHIDICHIMO (*Ann. di ost. e gin.; Zentralbl. f. Gyn.*, 1906, No. 40) reports the results of a series of experiments with dogs, in which he found that the lethal dose was about one-half grain to each two pounds of body weight. Large doses caused temporary lowering of the arterial tension and slowing of the pulse; the heart sounds remained regular except when the dose exceeded the therapeutic limit, nor was there any change in temperature or the respirations. Aspirin exercises a decided contracting action upon smooth muscles, especially those of the uterus, whether gravid or non-gravid, the effect being noted from fifteen to thirty minutes after administration of the drug. Therapeutically Chidichimo advises that from 30 to 45 grains be administered daily. He has never observed any ill effects.

Metaplastic Processes in Uterine Polyps.—KAUFMANN (*Abstract of Monograph in Zentralbl. f. Gyn.*, 1906, No. 39) presents the results of his studies of serial sections of cervical polyps, the pedicles of which were covered with cylindrical epithelium, while the distal portions presented several layers of squamous cells. He believes that the latter represent a metaplastic process and eventually replace the cylindrical epithelium. Hence the inference that in so-called "combined" carcinomas of the uterus, in which both squamous and glandular epithelium are found, the former replaces the latter over certain areas.

Epithelioma of the Uterus and Vagina.—BJORKENHEIM (*Abs. of Mono. in Zentralbl. f. Gyn.*, 1906, No. 39) found in the endometrium of young subjects yellow spots, which, on microscopic examination, presented the appearance of ordinary squamous epithelium, the cells having large nuclei disposed in rows parallel with the surface. The line of demarcation between the vaginal and uterine mucous membranes was thus clearly defined, though it differed in different specimens.

Lutein Cysts and Chorioepithelioma.—BURGER (*Zentralbl. f. Gyn.*, 1906, No. 39) presented to the Vienna Obstetrical Society a specimen from a patient aged thirty-two years, who, after missing three menstrual

periods, had passed a vesicular mole. Six weeks later she was admitted to the clinic on account of metrorrhagia and rapid enlargement of the abdomen. The diagnosis of double ovarian cystoma was made. On opening the abdomen, besides the cysts, it was found that the uterus contained an interstitial tumor, so that it was also extirpated. It contained several vesicular moles, presenting the histological structure of incipient malignant chorioepithelioma. The ovarian neoplasms were lutein cysts. Burger calls attention to the fact (noted by himself and others) that these cysts are not really derived from the corpus luteum, but from the proliferation of atresic follicles and the lutein transformation of their cells, hence, the name follicle-lutein cysts. He sees no etiological relation between these and the development of vesicular mole; on the contrary the circulatory disturbances due to the presence of the latter are more likely to lead to cystic degeneration of the ovaries. He believes that curettement in these cases is unwise, but that a radical operation should be performed at once.

Gonococcic Peritonitis.—LEOPOLD (*Zentralbl. f. Gyn.*, 1906, No. 43) reports the case of a patient, aged twenty-eight years, who on the sixth day after a normal delivery developed peritonitis. Bacteriological examination of the urethral and vaginal secretions showed numerous gonococci. On the following day laparotomy was performed, a quantity of purulent fluid being removed, which gave pure cultures of Neisser's coccus. Incision was made in both groins, with counter-openings in the loins; rubber drainage-tubes were inserted, a third drain being carried through into the vagina; all were repeatedly flushed with normal salt solution. The patient improved at once and made a good recovery. Commenting on this case, Leopold states that it was impossible to trace the time of infection, though the history and result of the bacteriological examinations left no doubt as to the origin of the peritonitis. It was particularly instructive from its bearing on obscure cases of puerperal infection. Importance is attached by him to the repeated flushings of the cavity after operation. (We had a similar unreported case, in which infection undoubtedly occurred two or three days before labor, as proved by the vaginal discharge and the fact that the child lost one eye from gonorrhœal ophthalmia. Unfortunately permission to open the peritoneal cavity was not obtained until the patient's condition was such that recovery was impossible. The case had been diagnosed as perforative appendicitis, occurring on the fifth day after delivery.—H. C. C.)

The X-rays in Menorrhagia.—GORL (*Zentralbl. f. Gyn.*, 1906, No. 40), reasoning from the reports of Tilden Brown and Halberstädter regarding the action of the *x*-rays on the ovaries and testicles in producing sterility, and the experience of Faveau de Courmelles in forty-five cases of fibromyoma, was induced to use this agent in the treatment of hemorrhage from the myomatous uterus. His success led him to infer that the atrophic action of the Röntgen rays on the ovaries was especially useful in cases of menorrhagia in which an operation was contraindicated on account of serious cardiac or renal disease. One application a week is advised.

DISEASES OF THE LARYNX AND CONTIGUOUS STRUCTURES.

UNDER THE CHARGE OF

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Micro-organisms in the Mouths and Throats of Healthy Persons.—In a study of the nature of micro-organisms found in the mouths and throats of healthy persons J. B. RUCKER, JR. (*Univ. Penna. Med. Bull.*, October 1906) reports a series of observations on twenty individuals who considered themselves in good health. He found streptococci and diplococci in all of them. Streptococcus mucosus was found in 70 per cent.; atypical pneumococcus in 50 per cent.; and typical pneumococcus in 25 per cent. It was learned that organisms of the same species may behave differently in their action on starch if the organisms are from different sources.

Tonsillitis.—In a paper on "The Relation between Tonsillitis and Acute Articular Rheumatism with Particular Reference to the Prophylaxis of Postanginal Rheumatism" (*Amer. Med.*, September, 1906) CHARLES F. KIEFFER, U. S. A., reports unusual success from a routine treatment as follows: A full mercurial purge on admission; gargling or spraying the throat with a saturated solution of sodium bicarbonate, followed immediately by the application of finely powdered aspirin to the tonsils. These applications are made thrice daily. In the series of cases thus treated the duration of the disease was but three days and not one instance of rheumatism developed.

Tuberculous Tumor at the Vault of the Pharynx.—SCHILLING (*Verhandlungen des Vereins Suddeut. Laryng.*, 1906) reports a case of tuberculous tumor in a healthy patient, aged fifty years, with normal lungs. The growth was removed with the incandescent snare, and a recurrence half a year later was destroyed with the galvanocaustic burner in two sittings. Schilling states that he has read of but two similar cases in literature, both reported by KOSCHIER (*Wien. klin. Woch.*, 1895).

Rupture of the Œsophagus into the Pleural Cavity.—THOMAS H. POTTER (*Amer. Med.*, September, 1906) reports a case of a man, aged forty-four years, who, after partaking of a liberal amount of whisky, beer, and free lunch, was suddenly attacked with a sharp pain in the precordial area, extreme physical weakness, and unquenchable thirst. In about three hours emphysema was noted at the root of the neck, and it rapidly extended over the chest, face, and arms. Death ensued eleven hours after the onset. The autopsy revealed three small ulcers, with rupture of the œsophagus at the site of one of them. The conclusions drawn

were that the cold beer had caused spasmodic contraction of the œsophagus with rupture into the pleural cavity through the thin walls at the point of ulceration.

Œsophagotomy.—In reporting two cases of œsophagotomy performed for the removal of dentures impacted in the gullet, WALKER DOWNIE (*Jour. Laryn., Rhin., and Otol.*, March, 1906) states that the gullet wall was not stitched, but the wound was lightly packed and allowed to granulate. The safety of this method, he states, cannot be overestimated. A rubber tube was passed through the nose into the stomach, by which the patient was fed, and this tube was retained in one case for three days and the other for four, and in each case the wound healed satisfactorily and completely without any complications.

Perforations of the Nasal Septum.—M. A. GOLDSTEIN (*Jour. Laryn., Rhin., and Otol.*, July, 1906) states that but little attention had been directed to perforations of the nasal septum and their most satisfactory treatment. He uses the Ballenger single tine swivel knife, and is enabled to cut away the rim of the cartilage smoothly and equidistant from the mucous edges along the whole circumference of the perforation. He uses a straight, sharp, Freer elevator in elevating the mucous membrane. The results have been uniformly successful.

The Rosenmueller Fossæ and Otitis Media.—THOMAS L. BRUNK (*Laryngoscope*, August, 1906) contends that in all cases of otitis media, due to infection, the primary cause lies in the diseased fossæ of Rosenmueller which are more or less filled with granular tissue which should be curetted. Several cases are detailed from some two hundred in the practice of Brunk to demonstrate his contention, and the favorable results from curetting the fossæ, which he accomplishes with a sterilized finger in preference to surgical instruments.

Paraffin Injections for Nasal Deformity.—At a meeting of the Laryngological Society of London, March 2, 1906, WALKER DOWNIE (*Jour. Laryn., Rhin., and Otol.*, March, 1906) reproduced a number of recent photographs of some cases of paraffin injections for nasal deformity, as well as other photographs taken immediately after treatment four years previously, which demonstrated that the shape of the nose was practically identical with photographs taken two weeks after operation, and that the injected paraffin can be felt as a well-defined firm mass, occupying the same site as it did immediately after injection. From some experiments and observations which he has made, Downie believes that the paraffin breaks up on its introduction, runs along the cellular planes, and is not eaten into later by the living tissues. It is held in position by the trabeculæ of the minute planes of cellular tissue in the same way as the fat of adipose tissue is kept in place. In his own cases he has never seen migration or wandering of the paraffin after it has once set. When paraffin has been found in other parts of the face he believes that it has reached those regions while the injections were being given, and while the paraffin was still in its fluid state. Dr. Downie uses paraffin with a melting point of 106° to 108° F. He employs the

electric current to keep the needle heated so as to maintain the fluid state of the paraffin during the procedure. At present he no longer employs either local or general anesthesia.

Laryngectomy in Two Stages.—Le Bec (*Ann. des maladies de l'oreille, du larynx, du nez, et du pharynx*, Septembre, 1906) reports a sixth case of total laryngectomy in two stages. The first stage comprised section of the trachea and its attachment to the skin anteriorly, a silver cannula being placed therein. Twenty days later the entire larynx was removed and an œsophageal tube was introduced through the nose into the stomach. The pharyngeal muscles were sutured in two planes around the tube, and all the soft parts were sutured with catgut. Two drainage tubes were placed at the sides and the skin sutured vertically. The sutures were removed on the twelfth day, the drain on the sixteenth, and the tube on the twentieth. Recovery took place without any special reaction, and the whispering voice had become quite perceptible. The growth had occupied both vocal bands and did not extend beyond the larynx. It was found to be an ordinary squamous epithelioma. Le Bec insists very much upon this procedure in two stages which really reduces the traumatism to its minimum, and has the advantage of allowing the patient time to recover strength between the two operative sittings

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PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

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The Presence of Syphilitic Antibodies in the Cerebrospinal Fluid of Paretics.—Based upon the work of Bordet, Gengou, Moreschi, Neisser, and Sachs, it has been possible for Wassermann and Bruck to devise a method by which the presence of minute traces of bacterial antibodies may be detected in the body fluids. It has been shown that if small quantities of blood serum from a syphilitic patient are added to a clear saline extract of the tissues from a syphilitic fœtus, this mixture is capable of preventing the action of fresh complement-containing serum, so that if one adds to this mixture fresh serum and sensitized red blood corpuscles, hemolysis does not proceed. The syphilitic blood serum or extract of syphilitic fœtal organs alone, or a mixture of syphilitic blood serum and saline extract of non-syphilitic fœtal organs, will not prevent hemolysis. Using this method Wassermann and Plaut (*Deut. med. Woch.*, 1906, xxxii, 1769) have investigated the spinal fluid of forty-

one paretics. Thirty-two of these spinal fluids when treated with a saline extract of syphilitic fœtal organs inhibited completely or almost completely hemolysis of sensitized red blood corpuscles in the presence of complement-containing serum. In four cases there was only slight inhibition and in five cases none. With twenty-two control spinal fluids from non-paralytics and two cases of acute meningitis, hemolysis was complete. Wassermann and Plaut believe that the patients, whose spinal fluids when tested by this method showed the presence of antibodies, must have had syphilis. In two cases, moreover, it was possible to show that the quantity of antibodies in the spinal fluid was greater than that in the blood serum. Although the number of experiments performed so far is too small from which to draw conclusions, they would suggest that in general paralysis the continuous production of antibodies by the nervous system may in some way bring about an injury to the nerve cells.

Experimental Studies on Syphilis.—Metchnikoff and Roux (*Ann. de l'Inst. Past.*, 1906, xx, 785), in the fifth communication upon this subject, publish some interesting facts and experiments to show that the syphilitic virus, after several passages through monkeys, becomes attenuated in its virulence. Throughout their previous work Metchnikoff and Roux have endeavored to find some way of accomplishing this result. In 1904 they suggested that Macacus rhesus, since this monkey was less susceptible to the syphilitic virus than the long-tail varieties, might fill the necessary requirements. Two rhesus monkeys, which were the subjects of experimental syphilis, were sent from Finger and Landsteiner, of Vienna. One of these was the eighth, the other the ninth monkey of a series which had been successively inoculated. The monkey of the eighth passage presented well-marked lesions; that of the ninth passage showed only the slight remains of a primary lesion. A chimpanzee inoculated with material from the two rhesus monkeys developed well-marked primary and secondary lesions, so that it was evident that eight passages through the rhesus monkey is not sufficient to attentuate the virus for higher apes. The virus was then inoculated from the chimpanzee through twenty-two rhesus monkeys. During these inoculations the lesions in the monkeys were observed to change in certain particulars. The primary lesion was found much earlier, appearing in the last few monkeys on the seventh instead of the nineteenth day, while the infection was of a much less severe nature. But the most important result was the attenuation of this virus for other monkeys. With inoculation of this virus the Javanese macacus developed very slight primary lesions after twelve days' incubation, while the chimpanzee, the most susceptible of all monkeys, proved entirely refractory.

They further relate certain observations made upon one of their assistant janitors, who developed a small round ulcer upon his lower lip. Most of the janitor's time was employed in caring for and handling the inoculated monkeys. Following the sore there was no glandular enlargement. The man feared that he had acquired syphilis, and though the lesion did not resemble exactly a chancre he induced Metchnikoff and Roux to make a complete investigation. To their surprise, in scrapings from the sore, they found typical spirochetæ of Schaudinn,

and monkeys inoculated with material from the sore developed unmistakable syphilis. The man then consulted Fournier, who could find nothing to justify the diagnosis of syphilis. For six months the man was carefully watched, but during this time did not develop secondary symptoms. The virus from this man was then inoculated into twenty animals, three chimpanzees and seventeen monkeys, representing in all five species. Of these, the three chimpanzees did not develop secondary symptoms. This suggested that the virus from this particular man was of an attenuated variety. When this virus, however, had once produced syphilis in monkeys it was capable of protecting the animals against a virus from other human sources. Metchnikoff and Roux believe that the man acquired his lesion from inoculated monkeys, and that the atypical character of the sore and mildness of the infection were due to the fact that the virus had been attenuated by passages through the monkeys. It could not be determined whether or not the man had been vaccinated against human virus, for he refused to be inoculated with material from human sources. The effects produced by the inoculation of virus from monkeys was, however, studied on one man who consented to undergo the operation. The virus had been passed through five Simian monkeys. Inoculations were made upon the arm of the man and at the same time upon the eyebrows of a chimpanzee. The chimpanzee developed a typical, primary lesion followed by swelling of the lymph glands, while the man, after an incubation period of twelve days, showed, at the site of inoculation, a crop of small papules which did not ulcerate, and which disappeared after a few days. In view of the great difficulty in determining what late effects may follow vaccination of human beings with virus attenuated by passages through monkeys, Metchnikoff and Roux do not believe much can be hoped for at present from this method of possible prevention. Until further experiments can be made they emphasize the importance and value of the use of calomel ointments as a prophylactic measure and cite cases to show that the contraction of the disease, which was almost certain to have occurred, was prevented by this method of treatment.

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CONTENTS.

ORIGINAL ARTICLES.

PAGE

The Medical Staff and its Functions: A Study in Hospital Organization 501

By S. S. GOLDWATER, M.D., Superintendent of Mt. Sinai Hospital, New York.

Abnormal Involution of the Mammary Gland, with its Treatment by Operation 521

By J. COLLINS WARREN, M.D., Professor of Surgery, Harvard Medical School, Boston, Mass.

The Surgical Aspects of Gastric Carcinoma 535

By JOHN B. DEAVER, M.D., Surgeon-in-Chief to the German Hospital, and the American Hospital for Diseases of the Stomach, Philadelphia.

Hydrocephalus Complicating Epidemic Cerebrospinal Meningitis . 547

By HENRY KOPLIK, M.D., Pediatrist to Mt. Sinai Hospital, New York.

Cardiovascular Regulation during and after Operation 560

By HENRY WIREMAN COOK, M.D., Minneapolis, Minn.

Clinical Studies of the Cerebrospinal Fluid, with Especial Reference to Pressure, Protein-content, and the Number and Character of the Cells 567

By F. PEYTON ROUS, M.D., Instructor in Pathology, University of Michigan, Ann Arbor, Michigan.

Tropical Neurasthenia and its Relation to Tropical Acclimation . . 582

By LOUIS H. FALES, M.D., of Madison, Wis., Formerly Physician and Surgeon to the Bilibid Prison Hospital, Manila, and Acting Attending Physician to the Civil Sanatorium, Bagino, Benguet, Philippine Islands.

Experimental Arterial Degeneration 593

By JOSEPH L. MILLER, M.D., Assistant Professor of Medicine, Rush Medical College, in Affiliation with the University of Chicago, Chicago, Illinois.

Some Congenital Anomalies of the Hands and Feet 602

By CLARENCE A. MCWILLIAMS, M.D., Instructor in Surgery, Columbia University, New York.

The Standards and Work of the Philadelphia Pediatric Society's Milk Commission. Embodying a Reply to a Criticism by Dr. A. H. Stewart, of the Philadelphia Bureau of Health . . . 608

By SAMUEL MCC. HAMILL, M.D., Secretary of the Philadelphia Pediatric Society's Milk Commission.

REVIEWS

PAGE

On Professional Education, with Special Reference to Medicine. By T. Clifford Allbutt, M.A., M.D., F.R.S. 619
Prevalent Diseases of the Eye. By Samuel Theobald, M.D. 620
Syphilology and Venereal Disease. By C. F. Marshall, M.D., M.Sc., F.R.C.S. 621
The Dynamics of Living Matter. By Jacques Loeb 623
A Text-book of the Diseases of the Ear, Nose, and Pharynx. By B. D. St. John Roosa, M.D., LL.D., and Beaman Douglass, M.D. 624
Operative Otology—Surgical Pathology and Treatment of Diseases of the Ear. By John Clarence Blake, M.D., and Henry Ottridge Reik, M.D. 625
Photoscopy (Skiascopy or Retinoscopy). By Mark D. Stevenson, M.D. 625
Chirurgie Oto-rhino-laryngologique. By Georges Laurens, M.D. . . 626

PROGRESS OF MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

WILLIAM OSLER, M.D., AND W. S. THAYER, M.D.

The Clinical History and Significance of Clubbed Fingers 627
Erythema Exudativum Multiforme and Nodosum of the Mucous Membranes and Their Relation to Syphilis 628
The Röntgen-ray Diagnosis of Unusual Heart Lesions 629
Fever 629
Muscular Cirrhosis of the Lungs 631
Eosinophilic Intestinal Disease 631

SURGERY.

UNDER THE CHARGE OF

J. WILLIAM WHITE, M.D., AND T. TURNER THOMAS, M.D.

A Contribution to the Study and the Treatment of Impassable Non-cancerous Strictures of the Œsophagus 632
The Appendicitis Question 634
Three Cases of Tumor of the Bladder without Hematuria 634
Tennis Elbow 635
Plastic Repair of the Peritoneum with Isolated Omentum 635
Surgery of the Hand 636

THERAPEUTICS.

UNDER THE CHARGE OF

REYNOLD WEBB WILCOX, M.D., LL.D.,

ASSISTED BY

HENRY HUBBARD PELTON, A.M., M.D.

	PAGE
The Pharmacology of Digalen	637
Ovarian Extract in the Obstinate Vomiting of Pregnancy	637
The Pharmacology of Veratrum	637
The Preventive Treatment of Serum Disease	638
Irrigations with Pulp of Pigs' Liver in Hepatic Cirrhosis and Tuberculous Peritonitis	638
The Treatment of Tuberculous Meningitis	638
Tuberculin Treatment	639
Sodium Citrate in the Dyspepsia of Adults	639
The Medical Treatment of Malignant Disease of the Stomach	639
Œsophageal Stricture Treated by Injections of Fibrolysin	640
Creosote Irrigations in Dysentery	640
Vegetable Iron; the Therapeutic Employment of Rumex Crispus	640
Milk as a Hemostatic	640
The Quinine Treatment of Cholera	641
The Treatment of Arteriosclerosis	641
The Intravenous Injection of Strophanthine	641

PEDIATRICS

UNDER THE CHARGE OF

LOUIS STARR, M.D., AND THOMPSON S. WESTCOTT, M.D.

Retarded Cerebral Development due to other than Cerebral Causes	642
Tetany Considered as an Intoxication by the Salts of Calcium	642
A Vegetable Broth Useful in Gastro-enteritis	643
The Alimentary Regimen of Measles	643

OBSTETRICS.

UNDER THE CHARGE OF

EDWARD P. DAVIS, A.M., M.D.

Eclampsia	645

GYNECOLOGY.

UNDER THE CHARGE OF

HENRY C. COE, M.D.

PAGE

Origin of Embryomas 648
Removal of the Ovaries in Myomotomy 649
Operations for Recurrent Carcinoma 649
Peritoneal Adhesions 649
Ovarian Pregnancy 650
Structure and Changes in Intraligamentary Tumors 650
Vapocauterization of the Uterus 650
Bier's Method of Intra-uterine Treatment 650
Thrombosis of the Vessels in Ectopic Gestation 650
Malignant Degeneration of Uterine Fibroids 651
Results of Radical Abdominal Hysterectomy for Uterine Cancers . . 651

DERMATOLOGY.

UNDER THE CHARGE OF

LOUIS A. DUHRING, M.D., AND MILTON B. HARTZELL, M.D.

A Case of Dermatomycosis Caused by the Microsporon Canis 652
A Case of Folliculitis Cutis Gonorrhoica 652
Two New Cases of Porokeratosis 652
Pathology and Therapy of Yaws 653
Mucous Membrane Lesions in Lupus Erythematosus 653

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

WARFIELD T. LONGCOPE, M.D.,

ASSISTED BY

G. CANBY ROBINSON, M.D.

Studies in Beriberi 653
Researches on Immunity to Carcinoma in Mice 654
Active Immunization of Man against Typhoid 655
Typhoid Bacillus Carries 655
Observations on the So-called Abnormal Fibrous Bands of the Heart . 656
Agglutinins and Specific Immune Bodies in Gonococcic Serum . . . 656